Technical Assistance Consultant's Report

Project Number: 46062
June 2015

People's Republic of China: Gansu Baiyin Urban Development II Project
(Financed by the ADB's Technical Assistance Special Fund)

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For Baiyin Municipal Government

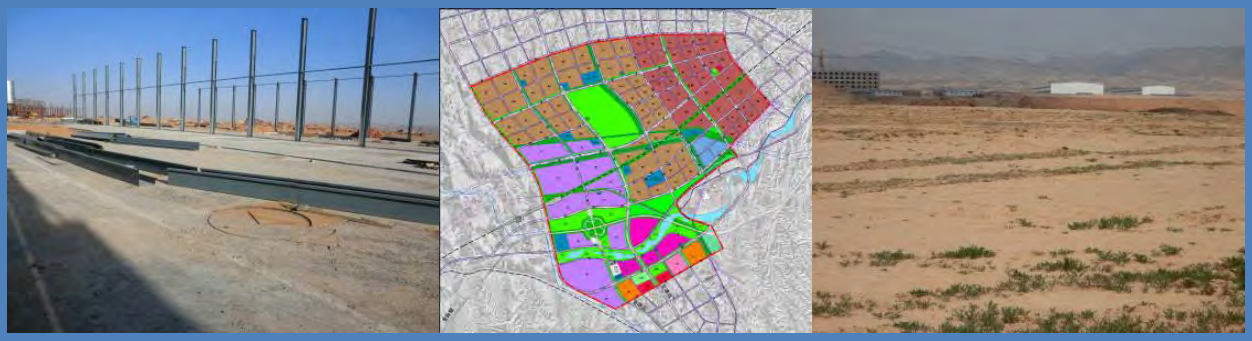
Asian Development Bank

Asian Development Bank

Final Report

Gansu Baiyin Integrated Urban Development Project

TA No. 8381 – PRC



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ABBREVIATIONS

ADB	Asian Development Bank
AIDS	Acquired Immunity Deficiency Syndrome
AIEC	Average Incremental Economic Cost
ANOVA	Analysis Of Variance
AP	Affected Person
BCR	Benefit-cost ratio
BMG	Baiyin Municipal Government
CF	Conversion Factor
CNY	China Yuan
CPI	Consumer Price Index
CQS	Consultants Qualifications Selection
CV	Contingent Valuation
CVM	Contingent Valuation Method
DB	Design-build
DBO	Design-build-operate
DFR	Draft final report
DI	Ductile Iron
DICL	Ductile Iron Cement Lined
DMF	Design and Monitoring Framework
DSCR	Debt-service coverage ratio
DRC	Development and Reform Commission
EA	Executing Agency
EBA	Earnings Before Tax
EBIT	Earnings Before Interest and Tax
EBITDA	Earnings Before Interest, Tax, Depreciation, and Amortization
EDR	Equalizing Discount Rate
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIRR	Economic Internal Rate of Return
EMDP	Ethnic Minority Development Plan
EMP	Environmental Management Plan
ENPV	Economic net present value
EOCC	Economic Opportunity Cost of Capital
EPA	Entire Project Area
EPB	Environmental Protection Bureau
ERD	Economics and Research Department
FA	Financial Analysis
FGD	Focus group discussion
FIA	Financial Impact Assessment
FIRR	Financial internal rate of return
FMA	Financial Management Assessment
FMAQ	Financial Management Assessment Questionnaire
FNPV	Finance net present value
FRP	Fiberglass Reinforced Plastics
FSR	Feasibility Study Report
FYP	Five-Year Plan
GDP	Gross Domestic Product
GHG	Greenhouse Gas

GPG	Gansu provincial government
GRP	Glass-reinforced Plastic
HDPE	High Density Polyethylene
HH	Household
HIVS	Human Immunodeficiency Virus
HURCD	Housing and Urban-rural Construction Department
IA	Implementation Agency
ICB	International Competitive Bidding
IDC	Interest during construction
IEE	Initial Environmental Examination
IFO	International Financing Organization
IP	Indigenous Peoples
IPA	Immediate Project Area
IRR	Internal Rate of Return
ITS	Intelligent transport system
JCG	Jingyuan County Government
LA	Land Acquisition
LCA	Least-cost analysis
LCB	Local competitive bidding
LCS	Least-cost selection
LDI	Local design institute
LIBOR	London interbank offered rate
LIP	Liuchuan Industrial Park
LMC	Liuchuan Industrial Park Management Committee
lpcd	liter per capita per day
MDG	Millennium Development Goals
MEP	Ministry of Environmental Protection
MIS	Management Information System
MLG	Minimum living guarantee
MOF	Ministry of Finance
MSL	Minimum Standard of Living
NBS	National Bureau of Statistics
NCB	National Competitive Bidding
NDRC	National Development and Reform Commission
NGO	Non-governmental Organization
NPV	Net Present Value
OCC	Opportunity cost of capital
O&M	Operation and Maintenance
PAC	Polyaluminium chloride
PAH	Project affected households
PAP	Project affected persons
PBRA	Project Benefits Reachable Area
PCCP	Prestressed Concrete Cylinder Pipe
PCR	Project Completion Report
PE	Polyethylene
PES	Payment for environmental services
PLG	Project Leading Group
PMO	Project Management Office
PPMS	Project Performance Management System
PPP	Purchasing power parity
PPTA	Project Preparatory Technical Assistance

PRC	People's Republic of China
PS	Pumping Station
PSA	Poverty and Social Analysis
PSP	Private Sector Participation
PVEC	Present Value of Economic Costs
QCBS	Quality Cost Based Selection
RC	Reinforced Concrete
RIB	Resettlement Information Booklet
RMB	Renminbi
RoW	Right-of-way
RP	Resettlement plan
RRP	Report and Recommendation of the President
SCF	Standard conversion factor
SDAP	Social development action plan
SEPP	Soil Erosion Prevention Plan
SERF	Shadow Exchange Rate Factor
SIA	Social Impact Assessment
STD	Sexually Transmitted Diseases
SWRF	Shadow wage rate factor
TA	Technical Assistance
TOR	Terms of Reference
TVET	Technical and Vocational Education and Training
uPVC	Unplasticized Polyvinyl Chloride
USD	United States Dollar
VOC	Vehicle operating cost
WACC	Weighted average cost of capital
WDS	Western Development Strategy
WF	Women's Federation
WS	Water Supply
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

CURRENCY EQUIVALENTS

(Assumed)

Currency Unit	–	Yuan (CNY)
CNY1	=	$.1639
$1	=	CNY6.1

MAP


刘川工业园短期规划范围
short-term planning area
of Liuchuan Industry park
刘川工业园中长期规划范围
Middle-long-term planning
area of Liuchuan Industry park
三滩乡Santan
Township
平川城区
Urban area of
Pingchuan District
糜滩乡Mitan
Township
靖远县城
Urban area of
Jingyuan County
白银城区
Urban area of
Baiyin City
刘川乡
Liuchuan
Township
109国道
国道
黄河
总体规划范围
本次规划范围
铁路
乡镇
县城
主城区


刘川工业园中长期规划范围
Middle-long-term planning area of Liuchuan Industry park
供水和污水配水管网覆盖范围
Coverage area of WTP and WWTP pipeline network
输水管 Main pipe for water supply
黄河
Yellow River
一级净水厂
First grade WTP
供水主管道
Main pipe between Yellow River and WTP
污水处理厂
WWTP
二级净水厂
Second grade WTP
西环路（亚行项目拟建设道路）
Xihuan Road(component of the project)
移民安置区
Resettlement living area
G6
S207

Project at a glance

1. Project Name: Gansu Baiyin Integrated Urban Development Project 2. Project Number: 46062
3. Country: People's Republic of China 4. Department/Division: East Asia Department / Environment, Urban and Social Sectors Division

5. Sector Classification:

Sectors	Primary	Subsectors
Multisector	✓	Water supply and sanitation
		Urban transport

6. Thematic Classification:

Themes	Primary	Subthemes
Environmental sustainability		Urban environmental improvement
Economic growth		Promoting economic efficiency and enabling business environment
Capacity development	✓	Institutional development

6a. Climate Change Impact

Adaptation	Medium
Mitigation	Low

6b. Gender Mainstreaming

Effective gender mainstreaming (EGM)	✓
Gender equity theme (GEN)	
No gender elements (NGE)	
Some gender benefits (SGB)	

7. Targeting Classification:

General intervention	Targeted intervention		
	Geographic dimensions of inclusive growth	Millennium development goals	Income poverty at household level
✓			

8. Location Impact:

Urban	High

9. Project Risk Categorization: Complex

10. Safeguards Categorization:

Environment	B
Involuntary resettlement	A
Indigenous peoples	C

11. ADB Financing:

Sovereign/Nonsovereign	Modality	Source	Amount ($ Million)
Sovereign	Project loan	Ordinary capital resources	100
Total			100

12. Cofinancing:

No Cofinancing available

13. Counterpart Financing:

Source	Amount ($ Million)
Government	79.88
Industrial and Commercial Bank of China	16.39
Bank of Gansu	16.39
Total	112.66

14. Aid Effectiveness:

Parallel project implementation unit	No
Program-based approach	No

I. THE PROPOSAL

1. A proposed loan to the People's Republic of China (PRC) for the Gansu Baiyin Integrated Urban Development Project.[1]

2. The project aims to promote inclusive and environmentally sustainable urban development in Baiyin Municipality, Gansu Province, by accelerated industrial transformation and economic diversification of Baiyin. The project will support basic urban infrastructure in Liuchuan Industrial Park (LIP) and strengthen education and training capabilities in Jingyuan County of Baiyin, install an intelligent transport system (ITS) in Baiyin District, and enhance the capacity to deliver municipal services for the project district and county.

II. THE PROJECT

A. Rationale

3. The People's Republic of China (PRC) has made remarkable progress in economic development and poverty reduction since 1980, but such progress has not been balanced across different regions. Located in the country's northwestern region, Gansu Province has lagged behind in the economic development and remains one of the poorest and least developed provinces in the PRC.[2] In 2013, the poverty rates in Gansu province were 8.4% for urban and 68.6% for rural households, significantly higher than the national averages of 2.8% and 13.1%. Development barriers facing Gansu include a harsh natural environment, remote inland location, underdeveloped infrastructure, and lack of investment. Such wide regional disparities prompted the Government of the PRC to launch the Western Development Strategy (WDS), with the aim to promote balanced economic growth and to raise the living standards in the region.[3] The strategy focuses on developing infrastructure, protecting the environment, and strengthening economic cooperation and trade with neighboring provinces and countries.

4. Baiyin is a medium-sized city in Gansu province (Gansu), one of the 12 less-developed provinces and autonomous regions targeted under the WDS. The city was originally established as a national copper mining base in the 1950s but its socioeconomic development suffered major setbacks after continuous copper exploitation and depletion, and environmental degradation. The urban poverty incidence of Baiyin is 10.46%, which is higher than the provincial (8.74%) and national (2.92%) average incidence. Since the Eleventh Five-Year Plan 2006–2010, Baiyin received special support from the national and provincial governments to jumpstart its industrial transformation.[4] The goal was to transform Baiyin from a resource-exhausted mining city into a new industrial center through technology upgrading and diversification of existing production chains, while achieving efficient use of resources and reducing adverse impacts on the environment. In 2008, Asian Development Bank approved the Gansu Baiyin Urban Development Project (Phase I project), providing assistance on urban road construction and district heating supply to support the initial stage of economic diversification in Baiyin district and Pingchuan district.[5,6] Although Baiyin's industrial output continued to grow by

[1] The design and monitoring framework is in Appendix 1.
[2] In 2013, per capita gross domestic product in Gansu was CNY24,438, compared with the national average of CNY41,805, second lowest in the PRC after Guizhou. The average annual per capita disposable incomes of urban and rural households in Gansu were CNY18,965 and CNY5,108 respectively, bring the second and the third lowest in the PRC, substantially lower than the national averages of CNY26,955 and CNY8,896 respectively.
[3] State Council of the PRC. 2000. *The National Strategy for Development of the Western Region*. Beijing.
[4] In 2008, Baiyin was listed as one of 18 national resource-exhausted cities which received special support for economic transformation under the Eleventh Five-Year Plan. Baiyin was also designated as a circular economy pilot city in 2009 and a resource-exhausted city transformation demonstration area in 2011.
[5] ADB. 2008. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for Gansu Baiyin Urban Development Project.* Manila.
[6] The outcome of the phase I project is facilitating economic transformation and improving quality of life in Baiyin. The project finances development of the South Baiyin Industrial Zone. All industrial areas have been fully occupied or committed by the private sectors.

13.5% annually in 2008–2013, urban infrastructures are still inadequate to support its economic diversification through industrial transformation. Baiyin's economy still lags behind as its per capita gross domestic product in 2013 remained at CNY26,757, only 64% of the national average of CNY41,805.

5. Baiyin's industrial transformation aims to facilitate inclusive and environmentally sustainable urban development. Although the Phase I project supported Baiyin to kick start its economic diversification, the city faces emerging urban development challenges. The water supply and wastewater treatment facilities are inadequate and land development cannot keep pace with the industrial transformation. Uneven urban–rural development broadens income disparities between two urban districts and three rural counties, thereby undermining inclusive socioeconomic growth. Limited opportunities for vocational capacity development also hinder the surplus labor force and laid-off workers from developing skills in support of the transition. Frequent traffic congestion and road hazards in the urban district adversely affect logistics and people's quality of life. The Phase I project does not support these sectors. Located in water stressed region of the PRC,[7] Baiyin needs innovative approaches to support its industrial transformation and meet its sustainable socioeconomic growth targets.

6. The project is to support: (i) development of Liuchuan industrial park (LIP); (ii) efficient water service for drinking and industrial processing; (iii) wastewater treatment for residential and industrial areas in LIP; (iv) strengthen technical and vocational education and training (TVET) capacity in Baiyin and Jingyuan; (v) enhance environmental management for industrial transformation; and (vi) enhance road safety and public transport management in Baiyin district.

7. The main project area is located in a 23-square kilometer planned area of LIP of the poverty-stricken Jingyuan County[8], one park of the "one zone and six parks" comprising Baiyin Industrial Concentrated Zone, which is a strategic industrial base of the Lanbai ("Lanzhou – Baiyin") Core Economic Zone. It aims to attract transfer of large and medium industrial enterprises from the Eastern Region, focusing on rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, utilities industries, and construction material industries, high quality processing of bases, and supporting logistics/warehousing facilities. The area possesses advantages in terms of land, coal, water, and labor resources. It comprises mostly of wasteland and low hills, with little farmland and few inhabitants. There are national and provincial level road and railway links. Water supply can come from the Yellow River only several kilometers (km) away.

8. Master planning and regulatory planning of the project area has been completed, and land formation, construction of some road subgrade, a resettlement area, and some industrial plants and ancillary buildings has started. The project will invest in a road and key urban infrastructure and services in the area to provide transport, water service for drinking and industrial processing, and wastewater treatment to improve the environment, and locals' quality of life. This will significantly improve the investment environment to attract more enterprises to move into the project area. Moreover, the development of LIP will provide significant job opportunities, about 77,000 for the industries and 8,000 for the services sector.

9. To complement the infrastructure construction for industrial development, the project will also (i) strengthen employment opportunities through skills training, targeting urban laid-off workers and rural surplus labor, (ii) develop a comprehensive environmental management system (EMS) for the LIP, to ensure safe, environmentally friendly and sustainable operations, and (iii) install an intelligent transportation system (ITS) in Baiyin District to help achieve smooth traffic, safe travel and good service for the transport development. The project will further scale

[7] Baiyin's average annual precipitation is 180–450 mm, while the annual evaporation is 1,500–1,600 mm.
[8] Jingyuan County's per capita gross domestic product in 2012 was CNY11,884, 54% of Baiyin's average. Gansu provincial government under its Twelfth Five-Year designates the Lanbai Core Economic Zone to accelerate the development of the industrial economic corridor from the provincial capital of Lanzhou to Baiyin.

up the outcome of the Phase I project by accelerating environment-friendly industrial transformation in Baiyin.[9]

10. **Strategic fit**. The project will contribute to balanced regional development in the PRC, thereby supporting the PRC's Twelfth Five-Year Plan, 2011–2015, which targets to attain the overarching goal of stable and relatively fast economic development by promoting livelihood improvement, environmental protection, and balanced socioeconomic development. By promoting sustainable and environment-friendly urban development, the project also aligns with ADB's PRC country partnership strategy 2011–2015, and is consistent with ADB's water and urban operational plans which focus on inclusive and environmentally sustainable growth, improved quality of life for developing a livable city, and mainstreaming efficiencies in water use.[10]

11. **Lessons learned and special features**. The project design incorporates lessons learned from ADB's five urban sector projects in Gansu. These are (i) keeping impacts of land acquisition and resettlement to a manageable level, and (ii) rigorously reviewing technical designs to avoid oversized infrastructures.[11] Together with the Phase I project, the project will demonstrate a sustainable model of urban development through industrial transformation for other resource-exhausted cities in the PRC. Individual special features of the project include (i) comprehensive support for skills training and vocational education for industrial transformation; (ii) enhanced environmental management in industrial areas; and (iii) installation of an ITS to address bottlenecks on transportation management.

B. Impact and Outcome

12. The impact of the project will be inclusive and environmentally sustainable development in Baiyin. The outcome will be accelerated industrial transformation and economic diversification of Baiyin.

C. Outputs

13. **Output 1: Liuchuan Industrial Park Infrastructure Development**. The project will build basic infrastructure of the Liuchuan Industrial Park including:

(i) a new water supply facility with treatment capacity of 60,000 cubic meters (m^3) per day, a 14.4-km water transmission pipeline, and a 14.0-km water distribution pipeline network and other related facilities for water supply;
(ii) a new wastewater treatment facility with treatment capacity of 35,000 m^3 per day, sludge treatment facilities and other auxiliary systems, and a 46.0-km wastewater collection pipelines network and related facilities; and
(iii) a 6.0-km road with related facilities including energy-saving streetlight, one bridge and one box culvert passing under the Beijing–Tibet expressway.

14. **Output 2: Technical and vocational education and training enhancement**. The project will strengthen capacity of TVET through following sub-outputs:

(i) development for long-term and short-term courses in Jingyuan County

[9] The Phase I project contributes to economic transformation and improvement of quality of life in Baiyin. The project finances development of the South Baiyin Industrial Zone, which has been renamed as "Baiyin High-tech Industrial Development Zone". As of December 2013, all industrial areas are fully occupied or committed by the private sectors.
[10] ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015*. Manila; ADB. 2012. *Urban Operational Plan*, 2012-2015. Manila.
[11] ADB assistance associated to urban development in Gansu province include: *Gansu Baiyin Urban Development Project* (Loan 2407-PRC, completed); *Lanzhou Sustainable Urban Transport Project* (Loan 2601-PRC, ongoing); *Gansu Tianshui Urban Infrastructure Development Project* (Loan 2760-PRC, ongoing); *Gansu Urban Infrastructure Development and Wetland Protection Project* (Loan 2903-PRC); and *Gansu Jiuquan Integrated Urban Environment Improvement Project* (Loan 3003-PRC).

Secondary Vocational School (JSVS) and public employment training centers including (a) upgrade of the training center and school facilities, (b) training courses equipment for logistic industry, ceramic industry, electromechanical industry, welding, plumbing, mold making, accounting, and restaurant housekeeping services, and (c) text books and training materials;

(ii) a labor market information system development including information and communication technology equipment, a computer software and training for public employment services;

(iii) teacher training and workshops for competency-based skill training courses development including (a) development and validation of occupational profile charts, (b) competency-based training modules, (c) evaluation and assessment methods and (d) course management and teaching quality assurance.

15. **Output 3: Intelligent transport systems installation**. The project will install two systems of traffic control and public transportation management including:

(i) an intelligent traffic command center, signal control equipment, electronic police/video monitoring and violation recording/traffic guidance equipment and an operational software; and

(ii) an operation center for the intelligent public bus service, public transport onboard equipment, stop and depot equipment, and an operational software.

16. **Output 4: Capacity development and institutional strengthening**. The project will strengthen capacity and institutions for the project's management and operation. It will provide expert support and advice on: (i) project management including contract management, financial management, safeguard and social monitoring and capacity development activities on ADB regulations; and (ii) EMS development for the LIP. It will support public awareness activities on subjects including road safety and provide training, seminars, workshops, and study tours on public financial management, industrial park development strategy and its environmental management, and innovative infrastructure financing options including public private partnership.

D. Investment and financing plans

17. The project cost is estimated at $212.66 million (Table 2-1).

Table 2-1: Project Investment Plan

Project component	Estimated project cost		ADB loan	
	(CNY million)	($ million)	(CNY million)	($ million)
LIP Infrastructure				
WWTP and associated pipelines	226	37.09	140	22.95
WTP and associated pipelines	551	90.27	284	46.63
Road construction	326	53.52	125	20.54
ITS	38	6.22	33	5.40
TVET	19	3.10	16	2.59
Survey, Design and Supervision	62	10.10	-	-
Capacity Development and Institutional Strengthening	14	2.43	13	1.88
Total	**1,297**	**212.66**	**610**	**100.00**

ITS = intelligent transport system, LIP = Liuchuan Industrial Park, TVET = technical and vocational education and training, WTP = water treatment plant, WWTP = wastewater treatment plant
Source: TA Consultants' estimates

18. The government has requested a loan of $100 million from ADB's ordinary capital resources to help finance the project. The loan will have a 25-year term, including a grace period of 5 years, a 10% annuity repayment option, an annual interest rate determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility, a

commitment charge of 0.15% per year, the interest during construction to be capitalized in the loan, and such other terms and conditions to be set forth in the draft loan and project agreements. Based on this, the average loan maturity is 18.31 years and the maturity premium payable to ADB is 0.20% per annum. The ADB loan will also finance taxes and duties for eligible ADB-financed expenditures, and transportation and insurance costs included in the base cost for ensuring smooth project implementation. The loan will finance 47.0% of the project cost. The government will finance $79.88 million through counterpart funds from BMG and JCG/LIP. The Industrial and Commercial Bank of China (Baiyin) and the Bank of Gansu will finance the remaining $32.79 million (Table 2-2).

19. The Government of the People's Republic of China is the borrower of the loan and will make the loan available, through the Gansu Provincial Government, to BMG on the same terms and conditions as those of the ADB loan. BMG will assume the foreign exchange and interest variation risks of the ADB loan. The People's Republic of China, Gansu Provincial Government, and BMG have assured ADB that counterpart funding will be provided in a timely manner, including any additional counterpart funding required for any shortfall of funds or cost overruns.

Table 2-2: Financing plan

Source	**Amount** ($ million)	**Share of Total** (%)
Asian Development Bank		
Ordinary capital resources	100.00	47.0
Baiyin Municipal Government	79.88	37.6
Bank of Gansu	16.39	7.7
Industrial and Commercial Bank of China	16.39	7.7
Total	**212.66**	**100.0**

Source: TA Consultants' estimates

E. Implementation arrangements

20. BMG is the Executing Agency for the project. BMG has established (i) Baiyin Project Leading Group chaired by its mayor to provide policy guidance and coordination, and (ii) Baiyin Project Management Office (BPMO) to supervise and coordinate overall project implementation. The four implementing agencies, Liuchuan industrial park management committee (LMC), Baiyin Municipal Public Security Bureau Traffic Police Detachment (TPD), Baiyin Municipal Public Transport Company limited (BPT) and Jingyuan County Bureau of Human Resources and Social Security (JHRSS) will physically implement the subprojects on behalf of BMG. Implementation arrangements are summarized in Table 2-3.

Table 2-3: Implementation Arrangements

Aspects	**Arrangements**		
Implementation period	January 2015–December 2019		
Completion date	31 December 2019		
Loan closing date	30 June 2020		
Management			
(i) Oversight body	Baiyin municipal government (BMG) project leading group.		
(ii) Executing agency	The BMG will be the executing agency and take overall responsibility for project implementation. The project management office, established under the BMG development and reform commission, will handle overall coordination and management of the project.		
(iii) Key implementing agencies	Four entities will be the implementing agencies and take overall responsibility for implementing subprojects. Implementing agencies will implement day-to-day activities including engineering supervision and procurement of goods and civil works.		
Procurement	International competitive bidding	7 contracts	$77.43 million
	National competitive bidding	12 contracts	$56.23 million
	Shopping	22 contracts	$0.99 million
	Non-ADB financing	2 contracts	$8.03 million
Consulting services	Individual consultant selection	6 person-months	$0.04 million

Aspects	Arrangements		
	Quality- and cost-based selection	111 person-months	$1.34 million
	Consultant's qualifications selection	24 person-months	$0.63 million
	Non-ADB financing	10 person-months	$0.25 million
Retroactive financing and/or advance contracting	Advance contracting and retroactive financing will be used. Retroactive financing will finance up to $20 million of eligible expenditure—20% of the Asian Development Bank (ADB) loan—that is incurred prior to loan effectiveness but not earlier than 12 months before the loan agreement is signed.		
Disbursement	The loan proceeds will be disbursed in accordance with ADB's *Loan Disbursement Handbook* (2013, as amended from time to time) and detailed arrangements agreed upon between the government and ADB.		

Source: TA Consultants

III. DUE DILIGENCE

A. Technical

a. Liuchuan Industrial Park Infrastructure

21. The project is technically feasible as a result of a detailed examination of the project's compatibility with the PRC's engineering guidelines, the projections of traffic demand, water demand and wastewater generation, the projected quality of receiving wastewater and treated wastewater, the minimization of environment impacts, water availability (e.g. abstraction quota) from Yellow river, and the risk of climate change. Development of other basic infrastructures in Liuchuan industrial pack has been on-going. All necessary infrastructures serving for industries in the LIP will be completed before the project completion date of 2019. Alternative technical option analysis confirmed that (i) operational feasibility of water and wastewater treatment systems, and (ii) consideration of appropriate road cross-section design ensuring road safety from heavy industrial vehicle operation. Located in water scarce region, treated wastewater will be reused for landscape irrigation and industrial reuse. The project will provide capacity development training to ensure sustainable operation and maintenance (O&M) of project facilities.

Water and wastewater

22. The current water supply and wastewater facilities are insufficient to serve the number of industries planned for the Liuchuan Industrial Park (LIP) by the year 2020 (short-term).

Water supply subcomponent

23. The plan for water supply is to take water directly from the Yellow River; provide preliminary treatment to reduce suspended solids; pump to a secondary water treatment plant (WTP) located within the LIP, treat, and distribute to industries and dormitory buildings within the LIP. For year 2020 facilities are sized to produce 60,000 m^3/d of water meeting PRC standards for drinking water. The water transmission pipeline is 14.4 km in length including a tunnel section of 205 m. The total water distribution system is 45.2 km of which 14 km is proposed for ADB funding. By year 2030 the facilities will expand to 200,000 m^3/d.

24. At the preliminary WTP there will be ten natural drying fields for sludge dewatering. The solids will be transported to waste land near the plant for disposal and to fill low elevation areas as needed. The estimated sludge production for preliminary WTP is 235 t/d. For secondary WTP, horizontal spiral centrifuge is selected for dewatering processes. After dewatering, the sludge with water content of about 80% will be used for filling land depressions, form berms, or used in a mix for building materials. The sludge production for the secondary WTP is estimated to be 80 t/d.

25. The water allocation for the LIP comes from reallocations so no new net water will be abstracted from the Yellow River, which is reliable water source with adequate quantity. Design, construction, operation and maintenance (O&M) are straight forward and the treatment process is reliable.

26. O&M costs for water supply treatment and distribution are estimated to be CNY1.03/m^3 (year 2014 prices) at full production capacity of 60,000 m^3/day.

Wastewater subcomponent

27. The plan for wastewater subcomponent is to collect and process (a) sewage from residential dormitories and offices; and (b) wastewater from industries. It will not include stormwater. With a rigorously enforced industrial pre-treatment program, the wastewater will be somewhat stronger than typical domestic wastewater and will meet the industrial wastewater discharge standards in each respective industry.

28. The proposed treatment scheme is developed around a proprietary process called G-BAF, a type of biological aerated filter, and is used elsewhere in the PRC to treat wastewater and industrial wastewaters particularly. The LDI has determined that G-BAF can treat to PRC Class 1A standards (GB18918-2002) making the treated wastewater suitable for reuse by industries and for landscape irrigation within the LIP.

29. The wastewater system for year 2020 will consist of (a) wastewater collection system, 46 km of DN400 – DN1,200 reinforced concrete pipe; and (b) wastewater treatment plant with design capacity of 35,000 m^3/d, expanding by year 2030 to 130,000 m^3 /d.

30. WWTP sludge will be mechanically dewatered and transferred for landfill, based on the widely used experience of this disposal method in the PRC. At start-up the sludge can be analyzed to determine its condition and possible use as soil amendment or, similar to water treatment residuals, used to fill low spots or construct berms.

31. **Public private partnership.** Regarding operation of the wastewater and water supply facilities, LMC will actively seek opportunities of engaging an experienced private operator to promote market-oriented reform in public utility services. With assistance of the TA Consultants, BPMO, LMC and ADB analyzed technical feasibility and financial affordability of various PPP scheme for operation and maintenance of the LIP water and sanitation facilities and shortlisted O&M and DBO as two potential PPP modes for water and wastewater services in LIP. In the long term, full concession of water and wastewater service in Jingyuan County was recommended by the TA and was agreed by both Jingyuan County government and LIP

Innovative features

32. Innovative features of water supply and wastewater include: (i) reuse of treated wastewater for industrial processes, landscape irrigation, and dust control; industries will build their own pipeline and pay a tariff rate that encourages reuse; (ii) water supply at different purification levels (e.g. before Water Treatment Plant, after sedimentation but before filtration) available to industries who will build their own pipeline; similar to reused water, the industries will pay a tariff rate that encourages use; (iii) Private sector participation for O&M; and (iv) potential link to the TVET component, which includes programs relevant to the O&M, laboratory, and administrative staff of the water supply and wastewater services.

Road

33. The road subcomponent includes construction of the 6 km long Xihuan Road and associated utility services, and related structures, including a 26 m long underpass beneath the G6 Expressway and a 30 m long bridge overpass above Dasha River. Xihuan Road is as an

urban road designed to urban Class II trunk road standard. The right of way width is 50 m with dual three motor-vehicle lanes. The design speed is 50 km/h. Utility services such as drainage and sewage, lighting and greening etc. will be provided along with the road construction.

34. Following the interim mission, extensive discussions and meetings have been held with the EA and LDI who is preparing the technical report and demand forecast. Engineering design and costing considerations has been reviewed and assessed. Additional information in relation to the demand forecast and road safety design has been collected and report updated.

35. The engineering design at this stage is considered adequate and up to the level of details of FSR in line with domestic FSR preparation guidelines. Alternative technical option analysis is considered appropriate. A few points especially on road safety and structural safety measures will need to be addressed during the preliminary design.

36. The wide road width design and the constraints for NMT users such as severance and long crossing distances may discourage green travel, increase vehicle speeds, and affect land use and road safety. Therefore road safety considerations should be given priority during preliminary design, not only to the proposed Xihuan Road, but also to all the roads in the LIP. Undertaking of road safety audit to the detailed design is recommended for all the roads within the LIP before approval of civil work contracts.

37. For the preliminary design, structural design will need to be elaborated with full consideration of geological survey results to determine the form of the sub-structure, hydraulic data will need to be supplemented and further analysis carried out; sufficient headroom for the structures should be ensured. Construction methodology should be further studied as it would have significant cost implications. Existing structures and landform should be carefully studied through site investigations.

38. Road component is considered a non-revenue-generating component. The EA/IA will need to secure sufficient counterpart funds during project implementation and funds for O&M during operations thereafter. Costs for routine maintenance for road are estimated to be CNY1.2/m^2; and major repair is expected every 5 years at the cost of five times of routine maintenance. Bridge maintenance costs would be 10 times of road maintenance costs.

b. Technical and Vocational Education and Training

39. The TVET subproject will support targeted communities benefiting from or impacted by the LIP development in Jingyuan County and Baiyin Municipality. It requires a comprehensive response to address current operational weaknesses in the sector, as well as building on existing strengths. The detailed TVET review in Jingyuan County and Baiyin municipality identified that overall priorities for development of TVET are already identified for funding and technical support in state and provincial plans. In practice, tertiary TVET has been prioritized through public investment in expansion and upgrading of the Baiyin Mining and Metallurgy College, which is also scheduled to receive support under the World Bank country program. A gap analysis identified, however, that the municipal TVET investment has more rooms for improvement in terms of systemic and institutional reforms in ensuring the availability of skills to meet changing economic conditions and employment demand, especially secondary TVET and adult-education. Priority areas of improvement include:

(i) TVET service provision for skills and knowledge required by new and emerging industries;
(ii) Partnership between industries and TVET providers;
(iii) TVET providers' institutional capacities to adjust and respond to new skill demands arising from local socioeconomic development;
(iv) Quality of teaching and availability of qualified teachers; and

(v) Labor market information systems to match appropriate skilled/non-skilled workers to existing and emerging industries

40. The contents of new long-term and short-term courses will be developed to meet the needs of industries in the LIP. The partnership between industry and TVET institute will be coordinated under the responsibilities of LMC, JCG and BMG during the project implementation. TVET service providers' capacities for curriculum development, teaching, assessment and evaluation will be systematically enhanced through training and workshop. Inefficient data collection and insufficient analysis of labor market demand and supply will be improved by development of a labor market information system, which enables to bridge the gap between labor skill demand–supply and communicates real-time labor training needs to the TVET service providers. The project will provide capacity development training for strategic human resource development and skilled improvement for rural-urban migrant workers and people-oriented development in Baiyin municipality.

c. Intelligent Transport Management System

41. The ITS subproject design was based on the current constraint and needs of traffic management in Baiyin district. The review and analysis of traffic conditions identified that the Baiyin district has sufficient road resources to accommodate number of registered vehicle in the district, but a gradual increase of registered vehicle started causing traffic congestions in the central city area especially at peak-hours and weekends. This was due to lack of appropriate traffic management equipment. Meanwhile, sharp increases of violation of traffic rules and regulations, and road accidents become evident in the central areas.[12] Public bus service in Baiyin was expected to offer alternative and preferred choice of mobility to people, but the obsolete public transport control and monitoring system failed to increase modal share of public transport. The ITS systems installed under the project will directly address these bottlenecks to enhance livability of central Baiyin district. Based on short-, medium- and long-term planning and strategy for traffic management, most appropriate and cost-effective investment components were identified. The project will provide capacity development training to ensure road safety and public transportation planning for small- and medium-sized city.

d. Capacity Building and Institutional Strengthening

42. The technical due diligence, financial management assessment and procurement assessment concluded that the project requires consulting service supports on: (i) facilitate project management and implementation, and provide capacity building and institutional strengthening, (ii) conduct external monitoring, (iii) provide support for implementation of TVET component, and (iv) design and installation of an EMS for the LIP. An estimated 151 person-months (14 international and 137 national) of consulting services are required. To support advance project actions, an individual project management and procurement specialist will be engaged to support the BPMO. This was followed by a project management consulting service comprising an urban/civil engineer, a contract management and procurement expert, an environment engineer, a financial expert, an environment expert and resettlement and social development specialists. An external resettlement and social monitor will conduct a compliance monitoring required under the ADB Safeguard Policy Statements (2009). Based on detailed reviews, gap analysis and consultation with local stakeholders, two specialized consultant teams have specific terms of reference to deliver successful TVET subproject and strengthened EMS in the LIP. Among the consulting services, and external resettlement and social monitor will be engaged by the LMC by using domestic funds. All consultants financed by ADB will be recruited according to ADB's Guidelines on the Use of Consultants (2013, as amended from time to time).

[12] Between 2010 and 2013, number of traffic violation increased by 5 times (12,025 cases to 76,519 cases) and number of major accidents increased by 2 times (35 cases to 68 cases).

e. Industrial sector

43. Rare earth new materials, non-ferrous deep metals processing, coal chemicals industries, equipment manufacturing and building materials industries were identified as the key industries to support Gansu Baiyin urban development planned to be located within LIP. Initial industrial assessment suggested looking at the wider value chain of industries relating to the industry priorities would allow for a stronger demand. Additionally, industries considered as attractive investment are to be considered expanding the initial list of industries.

44. The original list of industries would be expanded to include the production of high quality bases and materials which have high investment interest, the production of utilities to support the overall industrial transformation while strengthening municipal services, and the provision of facilities to support distribution of industrial outputs – warehousing and logistics are recommended. A study of international case studies reveals that supporting industrial development with logistics and service facilities is the current trend. And applying this approach for LIP will not only support industrial transformation but economic diversification as well. A review of international case studies also reveal certain management and environmental management practices that that are shared conceptually for the development of LIP.

45. Using historical output values and employment numbers by industrial sector at the provincial (Gansu) and municipal level (Baiyin) as the base data, it was important to validate the demand for these industries in the short term (2020) and in the long term (2030, 2033). Validation of the demand for these industries would allow for some level of check-and-balance or controls in terms of potential locators. It also allows the estimation of required industrial land for LIP.

46. Interviews were conducted with industrial operators/locators at LIP. Through interviews, operators/locators shared their estimated land requirements, employment requirements and potential economic value of their investments over time. The industrial demand assessment verifies which of the industries are supportable over time and provides some recommendations on demand, employment and land demand for these industries in the medium- to long-term. The findings of the industrial demand and supportable land demand would be presented in the loan fact finding mission.

47. Findings reveal that with estimated numbers of supportable jobs created, the previously estimated 2020 worker population of 46,000 persons is an aggressive estimate. This estimate is high compared to the estimated supportable worker population of 36,000 persons for an industrial driven development. However, the total supportable worker population catches up by 2030, and, is consistent across all three estimates (previous plan, locator estimates, and industrial demand driven) at approximately 92,000 persons. Given these worker estimates, a night-time population of 36,000 persons (2020) and 73,000 persons (2030) could be expected to be living on-site.

B. Economic and Financial

48. **Economic analysis.** Economic analysis was undertaken for water and wastewater, roads, ITS and TVET components. The economic analysis evaluated technical options and confirmed that all subcomponents were the least-cost ways to support the project design targets. For water supply and sanitation, the benefits are combined and include beneficiary willingness-to-pay for improved and expanded (incremental) water and sewerage services, improved health, and user resource savings. The willingness-to-pay price has been derived from the social survey that covered domestic and non-domestic users. Domestic tariffs were subjected to user affordability analysis to ensure tariff acceptability and subcomponent sustainability.

49. For the road subcomponent, the main benefit is time savings due to shorter travel route with the construction of the proposed 6-kilometer road project, and thus the time

consumed traveling. With the project, it is assumed the daily road users will travel on average 5 kilometers less.

50. The benefits for the ITS component derives from incidents avoided with the installation of technologically-advanced equipment at the identified areas and at the traffic operations center and at the traffic management bureau. For fatal accidents, benefits are valued from avoided labor output lost. For non-fatal accidents, benefits are measured from avoided medical cost and labor output lost during the recuperation period. Property damage cost is likewise valued from available Baiyin traffic police data. For the improvements in public transport system with the project, the main benefit is time savings on passenger waiting time at bus stations.

51. The benefits for the TVET component derive from potential higher wages for graduates of the technological and vocational schools. The graduates are expected to attain no less than the prevailing graduate hiring rates at 95%. There will be no shortage of students from Jingyuan County and Baiyin District where potential available labor force participants from the agricultural sector will average 2,000 annually, to total 35,000 by 2030. Salaries of graduates employed in LIP jobs are conservatively assumed to have a 10% premium over minimum wage by about 10%.

52. Economic internal rates of return were computed at 16.3% for the project overall, 15.7% for water supply and sanitation, 15.9% for the road subcomponent, 23.7% for TVET, and 16.5% for ITS, including Public Transport (PT) improvements. All exceed the economic opportunity cost of capital of 12%. Sensitivity analysis showed that the project's overall economic internal rate of return would drop to 13.6% under the impacts of a 20% capital and O&M cost overrun to 13.0% under 20% reduced benefits, further to 10.4% under combined 20% benefits reduction and increase in costs. A 1-year implementation delay will also result in a lower return at 14.1%.[13]

53. **Financial sustainability analysis.** The financial analysis was prepared for non-revenue and revenue generating project components. The non-revenue-generating components consist of the road, ITS and PT and TVET components. The revenue-generating components include water supply and wastewater treatment, the combined development to be constructed in the LIP and operated under PPP arrangements with a sole operator. In the analysis, the road subcomponent, to be constructed in the LIP, will be under JCG fiscal jurisdiction, with LMC shouldering the O&M cost. The ITS component will be under the TPD, under BMG, with BMG covering O&M cost. The O&M cost for the PT subcomponent will be under the Baiyin Public Transport Company. TVET funding recipients cover technical schools and institutes under the Jingyuan HRSS in JCG. The analysis assumed TVET funds to be transacted through JCG, however, beneficiaries will be from both BMG and JCG localities. BMG schools will receive quality uplift of teaching and professional staff and physical structures and systems, while JCG will earn from more highly-qualified labor force that will support opportunities in the LIP and lead to better assimilation of BMG drive towards transformation.

54. Financial impact assessment was carried out by assessing BMG, JCG and LIP finances to ensure the fiscal sustainability of the components during the implementation and operational phases. The fiscal impact was assessed by comparing annual revenues from the identified financing sources with the annual counterpart funds required for (i) capital expenditures during project implementation and (ii) recurrent costs for O&M and debt service during the operation period. The review of historical fiscal performance covering three to five years showed both BMG and JCG as having sufficient annual surplus funds. In 2012, BMG and JCG both received major funds from upper-level government subsidies comprising 70% and 77% of total fiscal revenue respectively. With the implementation of the project, BMG and JCG will be expected to contribute equity funds, while a major portion of financing will be sourced from domestic borrowings. Additionally, during the operational phase, BMG and JCG will have to provide operating funds to cover loans repayment and direct recurrent expenses. BMG, as final ADB

[13] Economic analysis is Linked Document 6.

borrower, will repay the ADB loan. JCG will be the borrower of the domestic bank loans needed by LIP to provide the counterpart fund requirement. JCG will repay the domestic loans and cover the annual O&M cost of TVET. The LIP will cover the road O&M cost.

55. For water supply and wastewater treatment subcomponents, demand was established for domestic and non-domestic usage including road watering and greening requirements. Demand follows industrial development schedules with horizons set at 2015-2017 for immediate improvement to serve existing industries and corresponding domestic worker household water requirements. Succeeding developments are phased in 2020 and in 2030 following industry and employment penetration forecast and incorporating worker-household members. In projecting revenues, the existing tariff schedule charged by the various water supply operators in Baiyin, Jingyuan, and Pingchuan have been reviewed and applied, with the rationale that these tariffs are acceptable to domestic and other users in the neighboring areas serviced by their providers. In the analysis, the current tariff was found insufficient and needed upward adjustment to cover the cash needs during the initial years (2017-2019), with succeeding increases at 10% triennially. Affordability analysis shows domestic tariffs to be within 0.3% and 0.6% of average wages of LIP's worker-dwellers, much lower than standard acceptable rates at 4-6% (including sewerage).

56. The revenue-generating water and wastewater subcomponents are financially viable at the required tariff schedule. The analysis indicates a financial internal rate of return (FIRR) for the base case at 3.4% with the real weighted average cost of capital (WACC) at 2.5%. The financial net present value (FNPV) is CNY96 million. Sensitivity analysis shows that at the tariff levels, the subcomponents remain viable with FIRR between 2.5% and 2.9% even with 10% cost overruns or delay in implementation. Decrease in revenue will pose risks to the project as FIRR goes down to 2.1%. Worst case scenario of combined reduced revenue and cost increases will result in FIRR at 0.8%.

C. Governance

57. Financial management assessment (FMA) were undertaken for direct project stakeholders including the Baiyin Municipal Government (BMG) Finance Bureau, the Liuchuan Industrial Park Management Committee (LMC), Baiyin Public Security Bureau Traffic Police Detachment (TPD), Baiyin Mining and Metallurgy Professional Technological School, Baiyin Public Transport (BPT) Company and Jingyuan County Bureau of Human Resources and Social Security (JHRSS). With the exception of the Finance Bureau, these entities have not been directly involved in managing externally-funded projects. All are found to have sufficient working budget and accounting systems. The staff numbers are adequate for current day-to-day activities. For new project requirements, staff will need to be complemented and will need specific training to comply with Bank guidelines for project fiscal management and reporting. The FMA rates the entities' financial management capacities as low to moderate (medium) risk, but with the adequate preparatory project training required of potential implementing units, the risk can be mitigated.

58. The project will be ADB's sixth urban sector loan project to Gansu province since 2007. Gansu Provincial Government (GPG) has an extensive experience on international financial institutes-financed projects including the World Bank and ADB. BMG also has experience in managing the ADB Urban Development (Phase I) project. All the implementing agencies have overseen the implementation of similar projects that were financed domestically. Procurement and financial management capacity assessments have identified weaknesses in the implementing agencies, including inadequate staff numbers and lack of direct experience with foreign-assisted projects. The project capacity development and institutional strengthening component will address these weaknesses. Through these risk mitigation measures, BMG, JCG, and the implementing agencies will gain the ability to undertake procurement and financial management in accordance with ADB policies and procedural requirements. ADB's Anticorruption Policy (1998, as amended to date) and its Accountability Mechanism Policy (2012)

were explained to and discussed with the GPG, BMG, and the implementing agencies. A procurement specialist will be engaged under the project as a start-up consultant for the BMG. A tendering agent will be engaged to support the tendering process. The project implementation consulting services will include both procurement and financial specialists to support project implementation and conduct training. Specific policy requirements and supplementary measures are described in the PAM.

D. Poverty and Social

59. Baiyin has a land area of 21,200 km^2 with a total population of 1.74 million and poverty incidence of 30.3% in 2012. The main project area is located in a 23-km^2 planned area of Liuchuan Industrial Park (LIP) of the poverty-stricken Jingyuan County, Baiyin Municipality. Jingyuan County has the second largest population among the districts and counties of Baiyin, with a total population of 0.48 million, and poverty incidence of 35.21% in 2012, which is much higher than the national average (15.41%). The industrial and financial crises arising from mineral resource depletion have resulted in the unemployment of numerous workers and a growing urban poor population. The estimated urban unemployment rates of Baiyin Municipality's and Jingyuan County were 22.3–22.5% in 2012, among the top in Gansu Province and the PRC. Investments by large and medium enterprises from the eastern coastal region of PRC are foreseen in LIP that include rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, warehousing, logistics, and construction material industries. The enterprises attracted to locate in the LIP will generate about 78,000 job opportunities, as well as 8,000 jobs created from the services sector, 30% of which will first be made available to the poor.

60. Poverty and social analysis was undertaken through a household survey, community and focus group discussions, and key informant interviews. The project will directly benefit people who will live and work in LIP, estimated as 39,000 residents and employees by 2015 and 123,000 residents and employees by 2030; indirect beneficiaries are the 2 million residents from Baiyin District and Jingyuan County. The TVET component will contribute to improved livelihoods for communities impacted by the Park's development, specifically through strengthening employment opportunities through skills training. About 87,000 rural and 6,000 urban residents of Jingyuan County are expected to benefit from the project through increased access to training and employment opportunities in a variety of sectors. In addition, the ITS component will benefit 276,500 residents of Baiyin District directly through providing safe and better traffic services. A social development action plan has been prepared to ensure inclusive benefits and will be implemented by the project management office in collaboration with other stakeholders during project implementation. A resettlement and social development specialist under the project management consulting service will monitor it.

61. **Gender benefits.** The project is categorized as effective gender mainstreaming. According to the Statistical Yearbook 2013 of Gansu Province, the population of Baiyin Municipality was 1.72 million in 2012, of which 48.6% was women. Over the years, the protection of women's rights and interests, and their development have been good in Baiyin Municipality. 48.2% of employees are women, almost equivalent to the percentage of the female population. However, there are still large gender differences in certain aspects. For example, in Baiyin Municipality, 70% of all community members are women, while only 14% of all village community committee members are women. Similarly, not more than 15% of leadership members of governments and functional departments at or above the township level are women. Survey and focus group discussions (FGDs) reveal that among the female respondents (40%), 20% do full-time jobs, 34.2% do part-time jobs and 46% are unemployed. Most women do not understand the labor law and labor security policies. Most female respondents support the project as it will generate more job opportunities through LIP construction, and are willing to work in the chemical industry if the health protection measures are sufficient. In addition, FGDs reveal that women are interested in gaining skills through training that will provide them with better non-farming employment opportunities, and the women consulted considered the

improvements in traffic safety and access to transport facilities to be provided under the project as important benefits.

62. The GAP includes specific targets for women in employment, vocational training, and participation that have been assured by the government. In addition to adequate staffing and training for BPMO LMC, women will be provided with (i) job opportunities during and after project implementation and from enterprises in LIP, (ii) training or education on labor law, labor protection and labor security program etc.; (iii) especially one existing short-term training course which almost 100% targets women to be strengthened, (iv) opportunities to participate in community management and decision-making processes, and (v) opportunities to participate in project design and LIP planning and management. The design and monitoring framework, and GAP include sex-disaggregated data and indicators. With the assistance of the social development specialist under the project management consulting service, BMG and JCG will be responsible for implementing the gender action plan and reporting on progress and achievements of gender benefits under the project.

E. Safeguards

a. Environment

63. The project is environment category B. An initial environmental examination (IEE), including environmental management plan (EMP) was prepared based on three domestic environmental impact assessments (EIAs) prepared for the infrastructure components, as well as a planning EIA prepared for the first phase of the LIP (23-km^2). The IEE complies with ADB's Safeguard Policy Statement (2009) and will be disclosed on the ADB website. It confirms that construction-phase impacts will be localized, short term, and can be effectively mitigated through the application of good construction practices and implementation of health and safety risk management plans defined in the EMP. Significant earthwork will disturb surface soils and could affect surface water in the project area through increased sedimentation. Adherence to the measures defined in the water and soil conservation plan will mitigate this risk. Dust and noise control will address the main concerns expressed by nearby residents.

64. During operation, noise insulation measures will be required for those households along the project road to ensure compliance with applicable noise level standard. The sustainability of water extraction for the water supply component on regional water resources was confirmed through regional water balance analysis in the context of the Yellow River water allocation plan. The effluent from the LIP WWTP will be reused for landscape irrigation and industrial reuse, contributing to increased resilience to climate variability, and likely to future climate change. The Project will provide capacity development support to help LMC establish an ISO 14001 certified EMS to enhance environmental management and emergency response capacity of the LIP and minimize environmental risks within the industrial park, targeting accreditation by 2025 as an eco-industrial park under PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009).

65. BMG will be responsible for the overall implementation and compliance with the EMP, including inspection, monitoring, reporting, and corrective actions or measures. Environmental management is supported by loan assurances and capacity development and institutional strengthening activities under the Project. BMG conducted meaningful consultation with potentially affected people and project beneficiaries. Environmental complaints will be handled in accordance with the grievance redress mechanism developed for the Project.

b. Involuntary Resettlement

66. The project is classified category A for involuntary resettlement. A resettlement plan (RP) was prepared in line with ADB's Safeguard Policy Statement and is currently being reviewed and finalized by ADB and the government. The plan will be disclosed to the affected persons

(APs) and uploaded to the ADB website by 20 June 2014 before the ADB's management review meeting. The RP will be finalized in line with the detailed engineering design and detailed measurement survey, disclosed to APs, and submitted to ADB for approval by the end of 2014. Compensation for lost assets and resettlement allowances will be paid to APs, and livelihood rehabilitation will be arranged in accordance with the RP. A due diligence report, prepared as an appendix of the RP, reviewed the collective land acquisition for the WWTP completed in August 2012 and for the road construction in the section north of National Highway 109 completed in November 2013.

67. Overall, the Project will occupy 1,158.31 mu of state-owned land and acquire 397.74 mu of collective-owned land and demolish 8,252.41 m^2 of rural residential houses permanently in 4 groups, 2 villages, and 2 townships of Jingyuan County. 67 rural households and 337 persons will be permanently affected due to the land acquisition and house relocation. 155 mu of land will be occupied temporarily with 46 rural households and 243 persons affected. 4 households with 20 persons affected by the project are vulnerable groups. The capacity development and institutional strengthening activities will include support for implementing resettlement. The implementation of the RP will be monitored and evaluated internally and externally. BMG and LMC have fulltime staff members responsible for land acquisition and resettlement (LAR) who will regularly report implementation progress and submit quarterly progress reports to ADB. The external monitor will review the progress and general welfare of APs to assess whether they have fully regained their standard of living. Monitoring and evaluation reports will be prepared semiannually during implementation and annually for 2 years after resettlement is complete. They will be submitted to ADB and publicly disclosed. The project has also established a transparent grievance redress mechanism (GRP) that will provide meaningful consultation and trigger remedial action defined for the project.

c. Indigenous People

68. The project is indigenous peoples category C. There is no concentrated area of ethnic minorities in the project area. The ethnic minorities live scattered in all residential quarters. 1.8% of the total municipal population is ethnic minorities and is primarily Hui. They enjoy the benefits created by the project in the same way as Han people. The project will not bring any special negative effect to the ethnic minority.

F. Risks and Mitigating Measures

69. Major risks and mitigating measures are described in detail in the risk assessment and risk management plan. The project's integrated benefits and impacts are expected to outweigh costs and risks.

IV. ASSURANCES

70. The government has assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the project administration manual and loan documents. The government has also agreed with ADB on certain covenants for the project, which are set forth in the loan and project agreements.

APPENDICES

1. DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact	**By 2022 (baseline 2013)**		**Assumptions**
Inclusive and environmentally sustainable development in Baiyin	Ratio of incomes of urban to rural residents reduced from 3.6 to 3.0 in Baiyin Municipality	Baiyin Statistical Yearbook	Development of the Lanzhou-Baiyin Economic Zone remains a national priority of the PRC government Socioeconomic development of Gansu province and Baiyin municipality is steady and in accordance with the Twelfth and Thirteenth five-year plans
	Percentage of unemployed population in urban area reduced from 22.3% to 10.0% in Baiyin Municipality	Baiyin Statistical Yearbook	
	Average per capita net income of rural households increased by 7% per annum from CNY5,772 in Jingyuan County	Baiyin Statistical Yearbook	
	LIP certified for the PRC Eco-Industrial Park by 2025	Annual report of LMC	
Outcome	**By 2019 (baseline 2013)**		**Assumptions**
Accelerated industrial transformation and economic diversification in Baiyin	Committed land area for industry increased from 24% to 42% in LIP	Annual report of LMC	Other urban infrastructures in Baiyin are timely constructed and operational. Project facilities are properly operating and maintained. TVET long-term and short-term courses serve direct needs of industries in LIP and Baiyin. **Risks** Actual economic growth and population are far from estimates. Baiyin and LIP become less competitive in industrial relocation from the eastern coastal region to western inland region.
	Industries operating in the LIP increased from 6 firms of 6 sectors to 15 firms of 8 sectors	Annual report of LMC	
	1,000 trainees enrolled with 80% of participants successfully completed for 3 existing and 5 new short-term training courses of which 40% are women	Jingyuan County Statistical Yearbook and annual reports of JSVS and PETC	
	Modal share of public transport in Baiyin District increased from 36.8% to 40.0%	Annual report of Baiyin Public Transport Company	
	Road accident deaths per 10,000 vehicles and traffic violations per vehicle reduced from 4.0 to 3.5 and 0.64 to 0.50, respectively	Baiyin Statistical Yearbook and data obtained by the ITS	
	206 and 181 unskilled jobs provided during construction and operation, of which 30% for women and 30% for the poor	Project completion and periodic progress reports	
	Industrial jobs increased from 14,000 to 28,000; 2,000 logistics and 8,000 service related jobs	Annual report of LMC	
	LIP certified under ISO 14001	Annual report of LMC	
Outputs	**By 2019**		**Assumptions**
1. LIP infrastructure developed and operational	A new water supply facility of 60,000 m^3/day, about 14.4-km water transmission pipeline, and about 14-km water supply pipeline network are operational	Project completion report	Project counterpart fund provided on time Other domestic financed projects are completed on time. **Risk** Delays in land acquisition approvals and implementation
	A new wastewater treatment facility of 35,000 m^3/day, about 46-km wastewater pipeline network, effluent reuse and discharge systems, and sludge disposal facilities are operational	Project completion report	
	A new road with length of 6 km is opened to traffic	Project completion report	
2. Technical and	1 new long-term and 5 short-term	Project completion	**Assumption**

vocational education and training enhanced and labor market database developed and operational	courses developed in JSVS and PETC with at least one course targeted for women	report	Government agencies and training institutions are committed to improve quality and relevance of training courses in collaboration with industries and enterprises. **Risk** Industries and enterprises are unwilling to collaborate in training course development.
	More than 60 teachers / instructors in 14 vocational schools / agencies in Jingyuan County are trained with at least 40% women.	Project completion report	
	Labor market database developed and operational	Project completion report	
3. Baiyin District ITS installed and operational	Traffic safety and security system are installed and operational.	Project completion report	**Assumptions** All government agencies associated with transportation management are closely collaborating.
	Public transport management and information system are installed and operational.	Project completion report	
	Road safety training conducted successfully with 50% women participation (public)	Project completion report	
4. Institutional capacity of the executing and implementing agencies strengthened	EMS developed and working for LIP	Project completion report	**Assumption** Project financing is provided on time. **Risk** Recruitment of the consulting services is delayed.
	Staff are trained and systems are in place for effective functioning of executing agency and implementing agencies, with 30% women participation	Project completion report	
Activities with Milestones **1. Liuchuan Industrial Park infrastructure development** 1.1 Complete detailed design and updated resettlement plans by Q1 2015 1.2 Complete land acquisition and resettlement by Q4 2016 1.3 Complete bidding and contract award by Q4 2017 1.4 Complete water supply facilities and pipelines by Q4 2019 1.5 Complete wastewater treatment facilities and pipelines by Q4 2016 1.6 Complete road and bridge by Q3 2018 **2. Technical and vocational education and training enhancement** 2.1 Develop curriculums for a long-term course by Q4 2016 2.2 Complete bidding and contract award by Q4 2018 2.3 Develop curriculums for short-term courses by Q4 2018 2.4 Develop a labor market information database system by Q4 2019 2.5 Conduct training and workshop by Q4 2019 **3. Intelligent transport systems installation** 3.1 Complete detailed design by Q4 2014 3.2 Complete bidding and contract award by Q4 2014 3.3 Install traffic security and control system by Q2 2015 3.4 Install public transport monitoring control system by Q2 2015 **4. Capacity development and institutional strengthening** 4.1 Engage and mobilize startup consultant from Q3 2014 to Q2 2015 4.2 Set up organizational arrangement by Q4 2015 4.3 Engage and mobilize project management consulting service from Q3 2015 to Q4 2019 4.4 Engage and mobilize TVET consultant from Q1 2016 to Q4 2019 4.5 Engage and mobilize EMS consultant from Q1 2016 to Q4 2019 4.6 Monitor and complete implementation of EMP, GAP, resettlement plan, and SDAP from Q3 2014 to Q4 2019 4.7 Conduct capacity building training from Q1 2015 to Q4 2019 4.8 Obtain ISO14001 certification for LIP by Q4 2019			**Inputs** **ADB: $100.0 million** **Baiyin Municipal Government: $79.9 million** **Others (Domestic banks): $32.8 million**

CNY = Yuan, EMP = environmental management plan, EMS = environment management system, GAP = gender action plan, ISO = International Organization for Standardization, JSVS = Jingyuan County Secondary Vocational

School, km = kilometer, LIP = Liuchuan Industrial Park, LMC = Liuchuan industrial park management committee, m^3/day = cubic meter per day, PETC = Public Employment Training Center, PRC = People's Republic of China, Q = quarter, RP = resettlement plan, SDAP = social development action plan, TVET = technical and vocational education and training.
Source: TA Consultants

2. LOAN ASSURANCES

A. Implementation Arrangements and Reporting

1. GPG and BMG shall ensure that the Project is implemented in accordance with the detailed arrangements set forth in the PAM. Any subsequent change to the PAM shall become effective only after approval of such change by BMG and ADB. In the event of any discrepancy between the PAM and this Project Agreement, the provisions of this Project Agreement shall prevail.

2. BMG shall cause the Implementing Agencies to ensure that all the Project implementation procedures agreed upon with ADB be followed including environmental and social safeguard requirements.

3. BMG shall, and shall cause the Implementing Agencies to, furnish to ADB all such reports and information as ADB shall reasonably request concerning (i) the Loan and the expenditure of the proceeds thereof; (ii) the items of expenditure financed out of such proceeds; (iii) the Project; (iv) the administration, operations and financial condition of BMG and the Implementing Agencies concerning the Project; and (v) any other matters relating to the purposes of the Loan.

4. Without limiting the generality of the foregoing (paragraph 3), BMG shall furnish to ADB periodic reports on the execution of the Project and on the operation and management of the Project facilities. Such reports shall be submitted in such form and in such detail and within such a period as ADB shall reasonably request, and shall indicate, among other things, progress made and problems encountered during the period under review, steps taken or proposed to be taken to remedy these problems, and proposed program of activities and expected progress during the following period.

5. Promptly after physical completion of the Project, but in any event not later than 3 months thereafter or such later date as ADB may agree for this purpose, BMG shall prepare and furnish to ADB a report, in such form and in such detail as ADB shall reasonably request, on the execution and initial operation of the Project, including its cost, the performance by GPG, BMG and the Implementing Agencies of their obligations under this Project Agreement and the accomplishment of the purposes of the Loan.

6. GPG and BMG shall, and shall cause the Implementing Agencies to, (i) maintain separate accounts and records for the Project; (ii) prepare annual financial statements for the Project in accordance with accounting principles acceptable to ADB; (iii) have such financial statements for the Project audited annually by independent auditors whose qualifications, experience and terms of reference are acceptable to ADB, in accordance with international standards for auditing or the national equivalent acceptable to ADB; (iv) as part of each such audit, have the auditors prepare a report (which includes the auditors' opinion on the financial statements, use of the Loan proceeds and compliance with the financial covenants of the Loan Agreement as well as on the use of the procedures for imprest fund and statement of expenditures) and a Management Letter; and (v) furnish to ADB, no later than 6 months after the end of each related fiscal year, copies of such audited financial statements, audit report and Management Letter, all in the English language, and such other information concerning these documents and the audit thereof as ADB shall from time to time reasonably request.

A. Safeguards

<u>Environmental</u>

7. BMG shall ensure, and cause the Implementing Agencies to ensure, that the preparation, design, construction, implementation, operation and decommissioning of the Project,

components, subcomponents and all Project facilities comply with (a) all applicable laws and regulations of the Borrower relating to environment, health and safety; (b) the Environmental Safeguards; and (c) all measures and requirements set forth in the IEE, the EMP, and any corrective or preventative actions (i) set forth in a Safeguards Monitoring Report, or (ii) subsequently agreed between ADB and BMG. BMG shall cause the Implementing Agencies to incorporate such respective mitigation and monitoring measures into the design and bidding documents and construction contracts.

8. GPG and BMG shall ensure that a Water Source Protection Zone will be developed and enforced in the Yellow River upstream of the Project's water supply intake location, meeting PRC standards before commission of the water supply plant.

9. BMG shall cause LMC to implement the necessary noise mitigation measures along the project road according to the requirements specified in the EMP and applicable national environmental protection regulations.

10. BMG shall cause LMC to ensure that (i) an environment management unit (EMU) is established under LMC; and (ii) this EMU is provided necessary budgetary and human resources to develop, implement and maintain an environmental management system (EMS) for LIP. BMG and LMC shall be fully committed to the goals and objectives of the EMS program including the ISO14001 certification by 2018, and eco-industrial park accreditation under the PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009) by 2025.

Involuntary Resettlement

11. BMG shall ensure, and cause LMC to ensure, that all land and all rights-of-way required for the Project are made available to the Works contractor in a manner and within timeframes compliant with the RP, and all land acquisition and resettlement activities are implemented in compliance with (a) all applicable laws and regulations of the Borrower relating to land acquisition and involuntary resettlement; (b) the Involuntary Resettlement Safeguards; and (c) all measures and requirements set forth in the RP, and any corrective or preventative actions (i) set forth in the Safeguards Monitoring Report, or (ii) subsequently agreed between ADB and BMG.

12. Without limiting the application of the Involuntary Resettlement Safeguards or the RP, BMG shall ensure, and cause LMC to ensure, that no physical or economic displacement takes place in connection with its respective part of the Project until:

(a) compensation and other entitlements have been provided to the displaced persons under the Involuntary Resettlement Safeguards as described in and in accordance with the relevant RP; and
(b) a comprehensive income and livelihood restoration program has been established in accordance with the relevant RP.

Safeguards-Related Provisions in Bidding Documents and Works Contracts

13. BMG shall ensure, and cause LMC to ensure, that all bidding documents and contracts for Works contain provisions that require contractors to:

(a) comply with the measures relevant to the contractors set forth in the IEE, the EMP, and the RP (to the extent they concern impacts on the respective affected people under the Environmental Safeguards and the Involuntary Resettlement Safeguards during construction), and any corrective or preventative actions set forth in (i) a Safeguards Monitoring Report or (ii) subsequently agreed between ADB and BMG;
(b) monitor relevant environmental impacts caused by the construction and

installation activities and report to the project management office;
(c) make available a budget for all such environmental and social measures;
(d) provide LMC with a written notice of any unanticipated environmental, or resettlement and social risks or impacts that arise during construction, implementation or operation of the project that were not considered in the IEE, the EMP, and the RP;
(e) adequately record the condition of roads, agricultural land, physical cultural resources and other infrastructure prior to starting to transport materials and construction; and
(f) reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition as soon as possible and no later than the completion of construction.

Safeguards Monitoring and Reporting

14. BMG shall do, or cause the Implementing Agencies to do, the following:

(a) submit Safeguards Monitoring Reports to ADB:
  (i) in respect of implementation of and compliance with Environmental Safeguards and the EMP, annually during construction and the implementation of the Project and the EMP until the issuance of ADB's Project completion report unless a longer period is agreed in the EMP; and
  (ii) in respect of implementation of and compliance with Involuntary Resettlement Safeguards and of the RP, semi-annually during the implementation of the Project, the RP until the issuance of ADB's Project completion report unless a longer period is agreed in the RP; and disclose relevant information from such reports to respective affected people under Environmental Safeguards, and Involuntary Resettlement Safeguards promptly upon submission;
(b) if any unanticipated environmental and/or social risks and impacts arise during construction, implementation or operation of the Project that were not considered in the IEE, the EMP, and the RP, promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan;
(c) no later than the date of award of Works contract, (i) update the EMP based on the final detailed design, and submit to ADB for its concurrence; and (ii) contract a licensed environmental monitoring agency who conduct periodic environmental impact monitoring in accordance with the approved monitoring plan;
(d) for social safeguards, engage an independent monitoring agency prior to commencement of land acquisition, acceptable to ADB which carries out monitoring and evaluation, including data disaggregated by gender and ethnicity where applicable; and
(e) report any actual or potential breach of compliance with the measures and requirements set forth in the EMP or the RP promptly after becoming aware of the breach.

Safeguards – Prohibited List of Investments

15. BMG shall ensure, and cause the Implementing Agencies to ensure, that no proceeds of the Loan are used to finance any activity included in the list of prohibited investment activities provided in Appendix 5 of the Safeguards Policy Statement.

Safeguards Grievance Redress Mechanism

16. BMG shall ensure that separate safeguards grievance redress mechanisms acceptable

to ADB are established in accordance with the provisions of the IEE and RP at its project management office, within the timeframes specified in the relevant IEE and RP, to consider safeguards complaints.

Applicability of ADB's Safeguard Policies

17. BMG shall ensure that the provisions of the IEE, EMP, and RP as well as any requirements under the Safeguards Policy Statement also apply to the portion of the Project to be financed by the Implementing Agencies and commercial banks.

B. Other Social Matters

Gender and Social Development Action Plans

18. BMG shall cause the Implementing Agencies to (a) resource and implement the Gender Action Plan including taking all reasonable and necessary steps to encourage women living in project areas to participate in the planning and implementation of the Project, targeting 30% or higher female participation in public awareness training for road safety, health protection and labor law; and (b) monitor the Project's impacts on women during project implementation every 6 months and report thereon in two quarterly progress report per year.

19. BMG shall cause the Implementing Agencies to (a) resource and implement the Social Development Action Plan, including a campaign on the prevention of HIV/AIDS and STIs, and (b) monitor its implementation every 6 months and report thereon in two quarterly progress reports per year.

Works Contracts

20. BMG shall ensure, and cause LMC to ensure, that the bidding documents for Works contracts include provisions to require the contractors to (a) prioritize employment of local people especially women and the poor; (b) provide equal pay for equal work; (c) provide the timely payment of wages; (d) maximize the use of local unskilled labor, as applicable; (e) comply with core labor standards and the applicable labor laws and regulations, including stipulations related to employment; and (f) not employ child labor. BMG shall further ensure and cause LMC to ensure that records of labor employment are properly maintained and tracked in the PPMS.

21. BMG shall ensure, and cause LMC to ensure, that the Works contractors will (a) implement an HIV/AIDS awareness and prevention training for all employees in collaboration with the relevant centers for disease control; (b) provide necessary measures to ensure the safety and health of their employees; (c) together with the local health bureaus, disseminate information on risks, hazards, impacts and prevention know-how on HIV/AIDS among their staff and workers on the construction sites and the local community through information disclosure, education and consultation; and (d) observe local customs concerning acceptable behavior toward the local population.

Public Awareness

22. BMG shall cause the Implementing Agencies to undertake public awareness campaigns on the Project and its benefits, including but not limited to information related to the EMP, the RP, the Gender Action Plan and the Social Development Action Plan, to be conducted through information disclosure, education and consultation, in both the local dialect and Mandarin.

C. Financial Matters and Operation and Maintenance

Counterpart Funding, and Operation and Maintenance

23. BMG shall provide counterpart funding in a timely manner, including any additional counterpart funding required for any shortfall of funds or cost overruns. BMG shall ensure that operation and maintenance of all Project facilities is fully funded, and that they will be operated and maintained in accordance with applicable engineering practices. Based on ADB's recommendation, BMG shall commence a review and provide recommendations on local regulations for effective setting and collection of water supply and wastewater tariffs and bus fares, and other user charges pertaining to revenue-generating projects. Effective and appropriate tariff setting shall cover all costs associated with provided services and taking into account ability to pay of the paying public, particularly vulnerable people.

24. BMG shall cause the Implementing Agencies: (a) to allocate appropriate human and financial resources for operation and maintenance of the project facilities and equipment; (b) to ensure that all works under the Project will be inspected, operated and maintained in accordance with prescribed standards, specifications and regulations and sound practices; (c) to ensure all equipment purchased under the Project is properly installed, maintained and operated; and (d) to ensure that all is fully functional.

25. BMG shall, and shall cause LMC to, ensure that the Project's water supply and wastewater treatment facilities will be managed and operated in highly professional manner considering using private sector participation, and that the WWTP shall meet Class 1A effluent standards.

Financial Management

26. BMG shall, and shall cause the Implementing Agencies to, establish and maintain sound financial management systems in accordance with ADB's Financial Management and Analysis of Projects, including the establishment of separate project accounts and the maintenance of minimum balances to ensure smooth cash flow and the timely settlement of project construction liabilities and future debt servicing. Project funds, including the Loan proceeds and counterpart funds, will be disbursed from the imprest account established under the Gansu Provincial Finance Bureau or the accounts of the BMG to contractors, Consultants, suppliers and affected persons.

D. Engineering and Technical Matters

Design and Construction Quality and Management

27. Prior to the commencement of construction of any part of the Project, BMG shall ensure that the Implementing Agencies shall have (a) ensured that all the respective Project facilities are designed and constructed in accordance with the national engineering norm and technical standards of the Borrower and the specifications defined in the EMP; and (b) ensured that construction supervision, quality control, and contract management for such facilities shall be carried out in compliance with the laws and regulations of the Borrower.

Water supply

28. GPG and BMG shall ensure that (a) there will be adequate allocation of water from the Yellow River to LIP, (b) Gansu Rare Earth Company will be connected to and use the LIP water supply system. Further, GPG and BMG shall, in case of future expansion of LIP, conduct full due diligence of regional water resources and adjust the water allocation plan to address increased pressure of limited water resources, also accounting for climate change.

29. BMG shall cause LMC to ensure completion, operation and connection of the water distribution network to all those enterprises that have settled in the 23-km^2 plan area of LIP upon completion and operation of the Project's water facilities.

Wastewater

30. BMG shall, and shall cause LMC to ensure that the Baiyin Municipal EPB will monitor and enforce PRC CJ343-2010 "Wastewater Discharges into Urban Sewerage Networks" including shutting off the water supply to consumers whose failure to comply will put the WWTP at risk of not meeting its discharge standards.

31. BMG shall, and shall cause LMC to: (a) complete the wastewater reuse network within LIP by 2019, allowing 100% reuse of the treated effluent in the LIP and (b) ensure that untreated wastewater from LIP, Gansu Rare Earth Company, and those households of Nanchuan Village and Nanshanwei Village in Liuchuan Township within the 23-km^2 plan area of LIP is discharged into the wastewater network after the completion and commissioning of, and treated in, the Project's WWTP.

Road

32. BMG shall cause LMC to cooperate with all relevant agencies to promote public transport and NMT and traffic safety provisions for the road constructed under the Project. BMG shall cause LMC to consider in detailed engineering design to include appropriately the provision of public transport and NMT, adequate traffic and safety signage, median separators, energy efficient street lights, drainage for storm water reuse, traffic control and other necessary facilities.

TVET

33. BMG and Jingyuan HRSS shall ensure that all related government agencies, schools, employment training centers, private training institutions, industries and enterprises are coordinated so that all expected project outputs are timely delivered and the project outcome will be achieved.

34. BMG shall cause, through Jingyuan County Government, Jingyuan HRSS and Liuchuan Industrial Park Management Committee to assign their full-time staff(s) responsible for coordinating all activities of the TVET component under the project.

35. BMG shall cause Jingyuan County Government, Jingyuan HRSS and Liuchuan Industrial Park Management Committee to facilitate discussions and agreements between enterprises in the Liuchuan Industrial Park, and Jingyuan County Secondary Vocational School and Employment Training Center on developing new long-term and short-term training courses and strengthening the existing courses to meet skills needs of existing, new and emerging industries in the Liuchuan Industrial Park.

36. BMG shall cause Jingyuan County Government, Jingyuan HRSS and Liuchuan Industrial Park Management Committee to ensure that new skills training courses developed in Jingyuan County Secondary Vocational School and/or Employment Training Center will include a course particularly targeting for women.

E. Change in Ownership

37. BMG and the Implementing Agencies shall ensure that during the Project implementation, in the event of (a) any change in the ownership or control of Project facilities; or (b) any sale, transfer or assignment of share or interest that results in a change of control in any agency owning or managing any Project facilities is anticipated, they will cause the relevant agency to consult with ADB at least 6 months prior to the implementation of such change. BMG, through the Implementing Agencies, shall cause the said agency to further ensure that the new controlling management of the concerned agency complies with (a) all project related

agreements executed between ADB and the Borrower or BMG; and (b) the policies of ADB relevant to the Project.

F. Governance and Anticorruption

38. GPG and BMG (a) acknowledge ADB's right to investigate, directly or through its agents, any alleged corrupt, fraudulent, collusive or coercive practices relating to the Project; and (b) agree to cooperate, and shall cause the Implementing Agencies and all other government offices, organizations and entities involving in implementing the Project to cooperate, fully with any such investigation and to extend all necessary assistance, including providing access to all relevant books and records, as may be necessary for the satisfactory completion of any such investigation. In particular, GPG and BMG shall ensure that (a) periodic inspections of the Project contractors' activities related to fund withdrawals and settlements are carried out; (b) relevant provisions of ADB's Anticorruption Policy (1998, as amended to date) are included in all bidding documents for the Project; and (c) contracts, financed under the Project, include provisions specifying the right of ADB to audit and examine the records and accounts of GPG, BMG, the Implementing Agencies, contractors, suppliers, consultants, and other service providers as they relate to the Project.

39. BMG shall also undertake the following anticorruption actions: (a) involving full-time officials from Baiyin Municipality and the Implementing Agencies' Discipline Investigation Bureau in the bidding, award and implementation of contracts; (b) introducing a dual-signing system, in which each contract winner signs an anticorruption contract with the employer when they sign and execute the contract; and (c) periodically inspecting the contractors' fund withdrawals and settlements.

40. In furtherance of the principles of transparency, participation, accountability and zero-tolerance for corruption, BMG shall disclose the Project information on the relevant websites that describe the Project in order to provide the public with information on the Project including (a) a summary of the audited financial statements of the Project; (b) the procurement plan and tracking of procurement contract awards; (c) any proposed tariff increases and associated scheduled public hearings; (d) relevant laws and regulations; and (e) information related to pro-poor subsidies.

Linked Documents

People's Republic of China: Gansu Baiyin Integrated Urban Development Project

TA No. 8381 – PRC

AECOM Asia Company Limited

June 2015

LINKED DOCUMENTS

1. Sector Assessment
2. Project Administrative Manual
   Attachment 1: Environmental Management System report
   Attachment 2: Environmental Management Plan
   Attachment 3: Procurement Capacity Assessment
      3a: Project Management Office
      3b: Liuchuan Industrial Park Management Committee
      3c: Baiyin Municipal Public Security Bureau Traffic Police Detachment
      3d: Baiyin Municipal Public Transport Company
      3e: Jingyuan County Bureau of Human Resources and Social Security
3. Contribution to the ADB Results Framework
4. Development Coordination
5. Financial Analysis
6. Economic Analysis
7. Country Economic Indicators
8. Summary Poverty Reduction and Social Strategy
9. Gender Action Plan
10. Initial Environmental Examination
11. Resettlement Plan
12. Risk Assessment and Risk Management Plan
13. Industrial Sector Analysis

LINKED DOCUMENT 1
SECTOR ASSESSMENT

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1.1 Overview of PRC

1. **Water Supply**[1]. The People's Republic of China (PRC) has almost 20% of the world's population but only 5% of the world's renewable freshwater supplies. The Ministry of Water Resources reports that of the 663 cities in the PRC, more than 400 are suffering from water shortages, with 110 classified as 'severe'.

Figure 1: Major Water Scarce Areas in the People's Republic of China

2. The above figure shows the distribution of the water scarcity areas in the PRC. Water shortage has led to overexploitation of groundwater, and other environmental and geological issues in the PRC. If proper measures are not taken timely, there will be increasingly large supply gap. It is estimated that by the year 2030, the total population in the PRC will reach 1.6 billion, water demand per year will increase to 818 billion m^3, and water supply gap will be 201 billion m^3.

3. The water usage is divided into four sectors: agricultural, industrial, domestic, and ecological (ecological water starts to be counted since 2003); the ratio for each sector is about 63.2%, 23.2%, 11.9% and 1.77% respectively. The average water usage in the PRC is 454.7 m^3/person/year (2012). For the industrial sector, the water supply kept increasing during 2000 to 2007, and remained relatively stable after 2008. (PRC Statistical Yearbook 2013)

[1] Ministry of Water Resources website (http://www.mwr.gov.cn/english/cpws.html)

4. According to the Ministry of Housing and Urban-Rural Development (MOHURD), out of the 4,000 water treatment plants in the PRC, the quality of the source water at less than half of them meets the national standard[2]. The Ministry has plans to upgrade about 2,000 water plants between 2011 and 2015, as well as build additional 2,358 water plants with a combined capacity of 40 million cubic meters per day to meet the demands of urbanization.

5. In response to reduced water resources, the PRC has implemented a program of desalination plant construction. According to the PRC State Oceanic Administration the desalination capacity is currently about 900,800 m³/d and costs are about CNY5-8/m³ ($0.81/m³ to $1.30/m³). Plants are located in islands lacking water and coastal cities with Tianjin Municipality, Hebei Province, and Shandong province having the most desalination capacity. It is planned that desalinated water will mainly be supplied to industries in the north of the country and households in the south[3].

6. **Governance in the Water Sector.** The primary national ministries are the MOHURD (formerly Ministry of Construction) with overall responsibility for urban water services and the Ministry of Water Resources with overall responsibility for rural water services. Table 1 lists other relevant national level organizations in the water sector.

Table 1: Summary of PRC Government Bodies with Water-Related Roles

National Agency	Responsibilities
State Council	Implementation of administrative orders and regulations, and overall coordination of ministries and agencies
Ministry of Water Resources	Integrated water resources, water resource protection planning, water function zoning, monitoring water quality in rivers and lakes, issue water extraction permits, proposing water pricing policies, and rural water services
Ministry of Environmental Protection	Supervisory and enforcement roles on water pollution laws, regulations, standards, and water environmental function zoning, and monitoring of water quality
National Development and Reform Commission	Pollution levy policy, wastewater treatment pricing policy, water pricing policy, industrial policies affecting wastewater discharge and treatment
Ministry of Finance	Pollution levy management, management of wastewater treatment charges, and water resource fee policy, State Office of Comprehensive Agricultural Development
Ministry of Housing and Urban-Rural Development (formerly Ministry of Construction)	Urban water supply, urban wastewater treatment
Ministry of Agriculture	Rural and agricultural water use and agricultural pollution from agro-chemicals
Ministry of Land and Resources	Water as a resource and land use planning
State Forest Administration	Using forests to conserve water sources
Ministry of Transportation	Ship transportation and water pollution control
State Oceanic Administration	Manages sea area use, and protects and conserves marine environment
National People's Congress	Legislation, law enforcement, and supervision

Source: KPMG (2012). Water in China: Key Themes and Developments in the Water Sector

[2] The PRC Environmental Quality Standards for Surface Water (GB 3838-2002) defines five water quality classes for different environmental functions: Class I for headwaters and natural reserve; Class II for 1st class of drinking water sources and habitats of rare aquatic organisms; Class III for 2nd class of drinking water sources, aquiculture and human contact; Class IV for water source of industrial use and recreation area for indirect human contact; Class V for water sources of agriculture use and landscaping requirement. There is also "worse than Class V".

[3] http://www.desalination.biz/news/news_story.asp?id=7687&title=China+ups+desalt+capacity+by+16%25

7. **Wastewater Sector in the PRC[4].** Wastewater in the PRC is classified as industrial or domestic (i.e. residential, commercial, social, and institutional). With increasing water efficiency and water reuse rates, the industrial wastewater generated has remained relatively steady. During the same period, residential wastewater discharge levels increased from a combination of factors including urbanization, rising living standards, and increased infrastructure to collect and treat wastewater. Figure 2 shows the total volume of industrial and residential wastewater between 2006 and 2012.

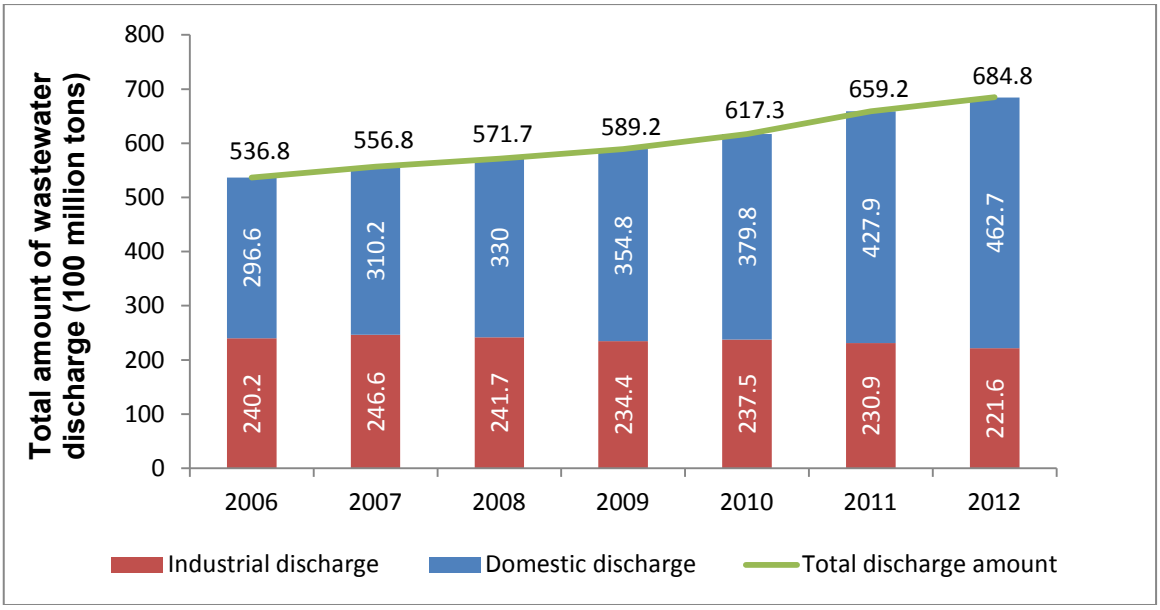


Figure 2: PRC's Wastewater Volume and Composition 2006-2012 (100 million tons)

Source: China Environmental Statistic Report from MEP (2006 – 2012) (http://zls.mep.gov.cn/hjtj/qghjtjgb/)
Note: The centralized wastewater treatment facilities (exclude the WWTP) for 2011 and 2012 are: 40 and 50 million tons, respectively.

8. Municipal governments are responsible for providing urban water supply and sewage processing.

9. With increasing investment in municipal wastewater treatment systems in recent years, there has been a significant rise in the number of wastewater treatment plants (WWTPs) and the overall wastewater treatment capacity in the PRC, the number of WWTPs in cities and counties at the end of year 2013 are shown in Figure 3. As of the end of 2013, the total wastewater treatment capacity reached 148 million m^3/day and average treatment capacity per plant is around 42,000 m^3/day.

[4] Data for Figures 2 through 9, as well as other PRC wastewater statistics unless otherwise noted, are from the "State of PRC's Urban Drainage and Wastewater Treatment 2006-2010", published by the Ministry of Housing and Urban-Rural Construction in 2012.

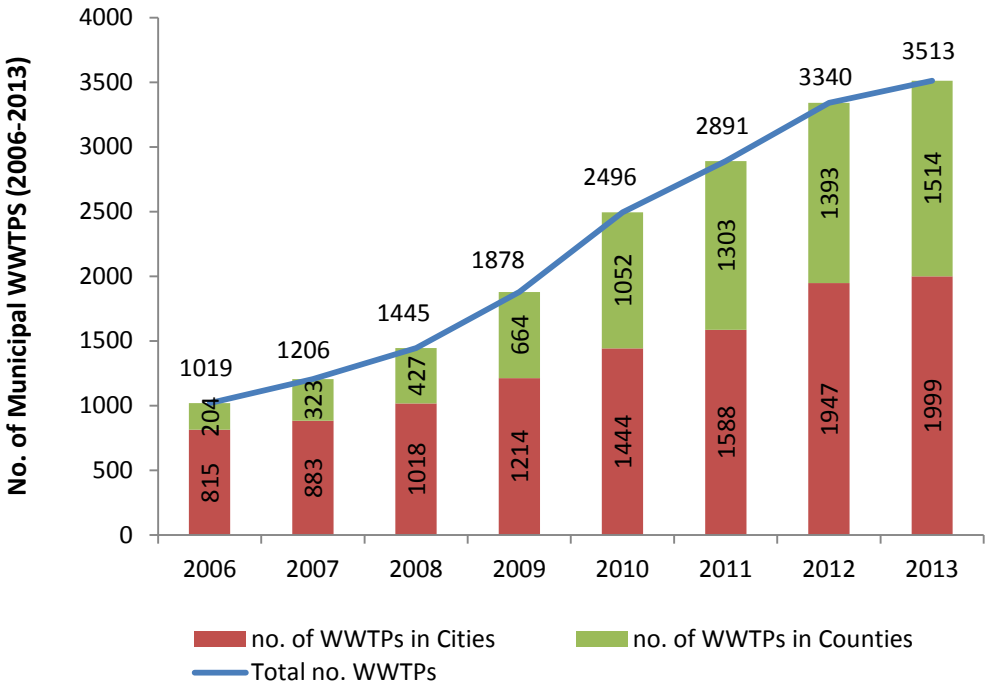


Figure 3: No. of WWTPs in the PRC (2006-2013)

Source: Report on China WWTP Construction and Operation from MOHURD (2006 – 2013)

10. It is reported that by the end of March in 2014, the total number of WWTP were 3,622, among which 2,051 WWTP (57%) are in cities with wastewater treatment capacity of 126 million m^3/day; and 1,571 WWTP are in counties and towns with wastewater treatment capacity of 28 million m^3/day. Therefore, by March 2014, the total municipal wastewater treatment capacity reaches about 154 million m^3/day and average treatment capacity each plant is about 42,400 m^3/day. Figure 4 shows the total municipal wastewater treatment capacity and treatment ratio[5].

11. Approximately 54% of the PRC's wastewater treatment capacity was built between 2005 and 2010, exceeding the targets set in the 11th Five-Year Plan (FYP) for Urban Wastewater Treatment. According to the "National 12 FYP for Construction of Urban Wastewater Treatment and Reuse Facilities" (paragraph 25), the targeted wastewater treatment capacity is 208.05 million m^3/d.

12. Figure 4 shows the gap between total treatment capacity and volume of water treated, which was 82.3% in 2013. A portion of this gap is due to engineering design to accommodate peak flows while the remainder results from incomplete wastewater collection network.

[5] Source: Report on China WWTP Construction and Operation from MOHURD

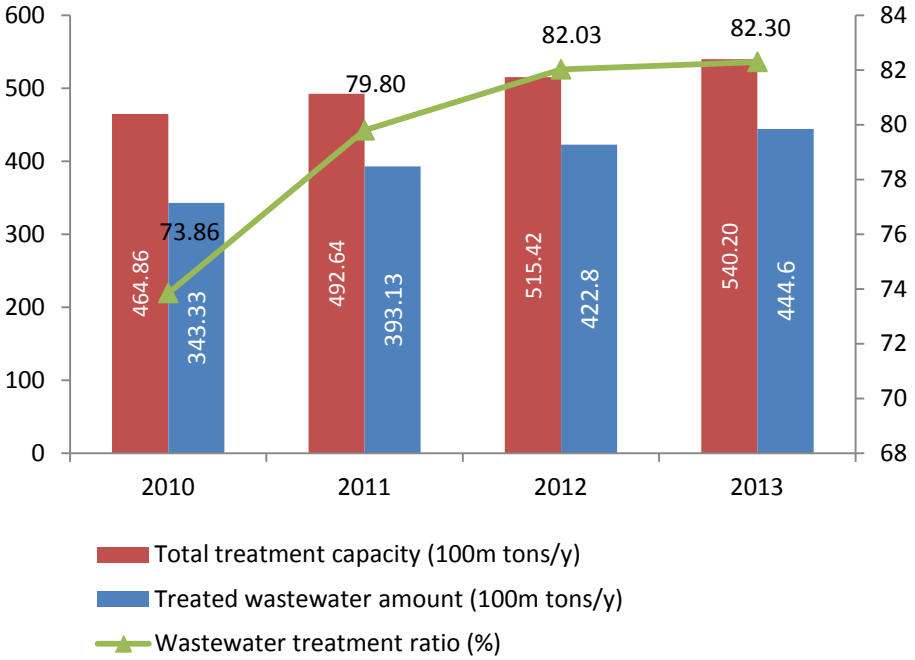


Figure 4: Municipal wastewater treatment capacity and treated amount in PRC (2010-2013)
Source: Report on China WWTP Construction and Operation from MOHURD (2010 – 2013)

13. Figure 5 shows the increase in length of sanitary sewers between 2006 and 2010, which is far less dramatic than the increase in treatment capacity. While 160,000 km of new sewer pipeline installations were planned between 2005 and 2010, only 70,000 km had been installed by the end of 2010. By 2012, the total length of ordinary sewers is about 439,080 km.

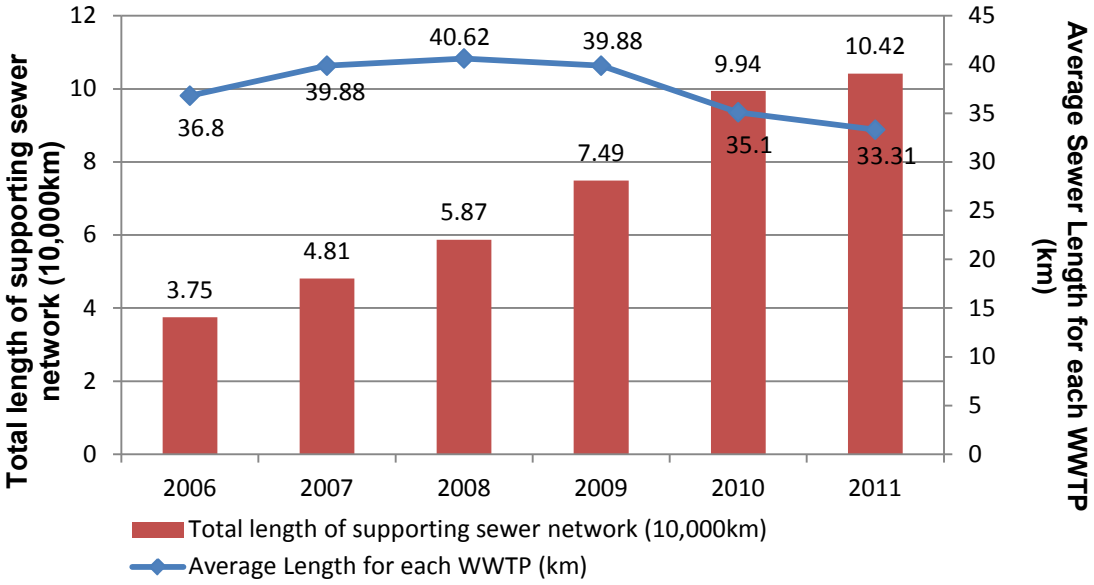


Figure 5: Length of Supporting Sewer Network for Municipal WWTP
Source: Research Report on China Wastewater Treatment Market (2012). [2013 version is not available online].

14. Industrial Wastewater. The PRC generated 23.09 billion and 22.16 billion tons of industrial wastewater in 2011 and 2012, respectively. Although the volume of industrial wastewater has remained relatively steady over the years, the amount of pollutants discharged in the wastewater is declining due to the increasing number of industrial wastewater treatment systems being built, as shown in Table 2 for years 2003 – 2012. Table 3 shows amounts of Chemical Oxygen Demand (COD) and Ammonia Nitrogen (NH_3-N).

Table 2: Industrial Wastewater and Pollutants Discharged in the PRC

		Amount of Pollutant Discharged in Industrial Wastewater									
		(tons)							(10,000 tons)		
Year	Industrial wastewater discharged (10^8 tons)	Mercury	Cadmium	Hexavalent Chromium	Lead	Arsenic	Volatile Phenols	Cyanide	COD	Petroleum	Ammonia Nitrogen
2003	212.3	5.5	84	103	568	374	2,246	639	512	2.45	40
2004	221.1	3.0	56	151	366	306	1,563	630	510	2.41	42
2006	240.2	2.6	49	96	339	245	3,453	457	542	1.92	42
2007	246.6	1.2	39	69	320	187	2,926	382	511	1.69	34
2008	241.7	1.4	39	75	241	215	1,916	256	458	1.33	30
2009	234.4	1.4	32	55	182	197	1,045	250	440	0.95	27
2010	237.5	1.0	30	55	141	118	1,143	242	435	1.01	27
2011	230.9	1.2	35.1		150.8	145.2	2,410	215.4	354.8	2.06	28.1
2012	221.6	1.1	26.7	70.4	97.1	127.7	1,481	171.8	338.5	1.73	26.4

Source: PRC Environmental Statistical Yearbooks from MEP (http://zls.mep.gov.cn/hjtj/nb/)

Table 3: COD and NH_3-N in PRC Wastewater in 2013

Chemical Oxygen Demand (COD) (units of 10,000 tons)				
Total	Industrial	Domestic	Agricultural	Other
2353	320	890	1126	18
Ammonia Nitrogen (NH_3) (units of 10,000 tons)				
Total	Industrial	Domestic	Agricultural	Other
246	25	141	78	2

Source: Ministry of Environmental Protection
http://www.mep.gov.cn/zhxx/hjyw/201406/W020140605385940287254.pdf

15. Industries that generate the most amount of wastewater include paper, chemicals, textiles, food and beverage, power, ferrous metal smelting/pressing, and coal mining/washing, as shown in Figure 6.

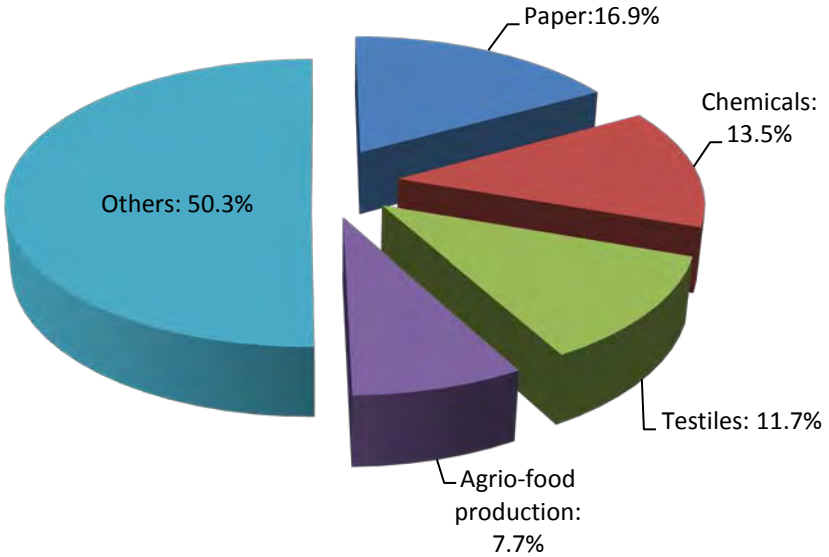


Figure 6: Industry Contribution to Total Industrial Wastewater Amount Generated (2012)
Source: PRC Environmental Statistical Yearbook (2012)
(http://zls.mep.gov.cn/hjtj/nb/2012tjnb/201312/t20131225_265553.htm)

16. **Sludge Treatment and Disposal.** International best practice for sewage sludge is first to rename it and second to use it. Renaming it “bio-solids” removes the stigma associated with words “sewage” and “sludge” and makes the association that the material is biological. Uses of bio-solids include (a) composting to make a soil amendment useful for land reclamation and landscaping; and (b) energy recovery through anaerobic digestion that produces methane gas which is converted to energy. Besides beneficial use of what is usually considered a waste product, these processes also release less Greenhouse Gas (GHG) emissions than if disposed to a landfill.

17. It is important to note that (a) composting is not self-financing and requires a subsidy to make up the difference between production costs and sale price; and (b) energy recovery requires legislation and regulations to allow sale of energy and requires infrastructure for the energy to enter the electricity grid. So implementing these sludge treatment methods is neither simple nor without additional costs.

18. Over 20 million tons of dewatered sludge, with 80% moisture content, were produced in the PRC in 2010, with only 25% being treated or disposed of in a safe and effective manner. It is expected about 33.59 million tons of dewatered sludge will be produced by the year of 2015. In WWTPs with a capacity of less than 100,000 m^3/day, the sludge is normally only dewatered before it is sent outside the WWTP for disposal. Even many of the facilities in the country with sludge stabilization systems (especially digestion processes) are not operating regularly. MOHURD estimates more than 80% of sludge is currently sent for direct landfilling, often in sub-standard rather than sanitary landfills. Other disposal methods like composting of heat-dried sludge, energy recovery, co-incineration, and land application are not widely used. Sludge has become an urgent environmental issue for many cities, especially large or densely-populated cities where nearby land is not available for disposal.

19. The PRC 12 FYP specifies that all WWTPs with capacities over 100,000 m^3/day should properly treat and safely dispose of all sludge produced, and by 2015 the national sludge treatment rate should reach 50%. See Table 4 for more specific sludge treatment targets.

20. The 12 FYP promotes waste-to-energy for solid waste disposal (e.g. landfill gas recovery, bio-digestion, and incineration). In various locations wastewater bio-solids are co-combusted to produce energy. This suggests it would be useful for the PRC to do a pilot project for evaluating the feasibility of co-combusting domestic solid waste and domestic bio-solids.

21. **Water Reuse.** In the PRC, wastewater reclamation and reuse is not commonly applied with the exception of a few large cities in northern China, for example Beijing. In 2010, approximately 3.3 billion m^3 of municipal wastewater was reused, which is approximately 10% of the wastewater generated. However, in 2011, the municipal wastewater reuse amount is about 2.7 billion m^3 and the wastewater reuse rate is approximately 7.95% (Report of Reclaimed water Market in China 2013). Major reasons for low reuse rates include the uncertainty of reclaimed water prices, issues with pipeline construction (i.e. having separate system for reclaimed water), and the stability of the customer base. In southern China, since most areas receive abundant rainfall, water reuse is not common although it has been included in government plans. Even in southern cities that suffer frequently from drought, water reuse has not received the attention it deserves and no actual progress has been made.

22. As presented in Table 4 the overall water reclamation rate of municipal WWTPs should reach 15% by year 2015. The standards for the quality of treated effluent are raised to a higher level, e.g. from Class 1B effluent discharge to Class 1A, in order to promote reuse and recycling applicability[6].

[6] PRC GB 18918-2002 "Urban Sewage Treatment Plant Pollutant Discharge Standards" lists parameters and limits that determine the class of wastewater. See Table 5.

23. As an incentive, the PRC government encourages the development of wastewater reclamation and reuse projects by compensating 50% of the building and construction cost, thus stimulating the development of a water reclamation industry. National and local authorities in the PRC now consider the membrane bioreactor (MBR) process to be a leading technology for wastewater treatment for reuse purposes. The country's "Catalog of Environmental Protection Industry Equipment (Products) Encouraged by the State" listed the MBR as the first technology in its 2010 edition[7].

24. **Wastewater Tariffs.** The PRC Government issues guidelines on wastewater tariffs while local governments set their own tariff levels based on local conditions. The central government encourages setting of wastewater tariffs at a level that covers costs and provides a marginal profit. Local governments unable to meet this requirement should develop minimum wastewater tariffs based on actual operational costs of local WWTPs.

25. Since 2007, the PRC's standard for wastewater tariffs has been a minimum of CNY0.80/m^3, as announced by the Ministry of Construction (now MOHURD). Most of the prefecture-level cities and many of the county-level cities in the PRC have already built municipal WWTPs and started collecting wastewater tariffs. However, the wastewater tariff rates vary significantly, ranging from CNY0.15/m^3 to as high as CNY1.5/m^3. Over a quarter of the cities where wastewater tariffs are levied have rates that are too low to cover costs[8]. Another common issue is that the wastewater tariffs do not include the cost of sludge treatment and disposal. Most wastewater tariffs are levied as part of water supply tariffs, including in Baiyin. However, there are some cities where wastewater companies collect fees on their own (e.g. Tangshan) and in those locations the wastewater tariff collection rate is typically less than 90%. Figure 7 shows the water tariffs for different categories in major cities in PRC in 2012.

[7] ADB "Country Water Action: Innovative Technology for Wastewater Reclamation", 14 August 2012

[8] Wastewater treatment tariffs were introduced in more than 450 Chinese cities for the first time in 2006. Tariffs were meant to be introduced in other cities over the following two years, but the status of the tariff roll-out as policy guidance rather than compulsory regulation means that the central government lacks a mechanism to force local governments to implement it.

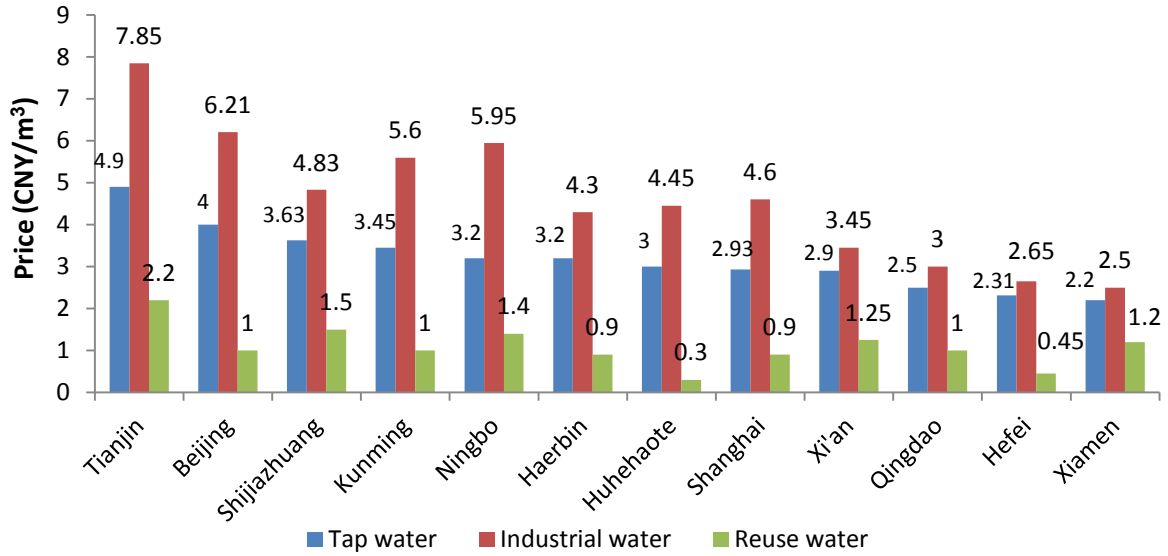


Figure 7: Water tariff for some major cities in PRC (2012)
Source: Report of Reclaimed Water Market in China (2013 version)

26. **Objectives, Requirements, and Trends.** The 12 FYP strongly supports wastewater treatment, waste-to-energy, and water recycling. One of the primary guidelines of domestic economic and social development in the 12 FYP is to keep building a resource-conscious, environmentally-friendly society to accelerate the transformation of economic development. The 12 FYP establishes the environmental protection industry as the first of seven strategic emerging industries, and creates a series of standards and indicators to stimulate the development of the industry.

27. The "Decision of the CPC Central Committee and the State Council on Accelerating the Development of Water Reform" ("No. 1 document") published on 29 January 2011 calls for the implementation of three very strict water resource management regulations and the establishment of the "Three Redlines": (a) overall water use; (b) water use efficiency; and (c) wastewater discharge control of pollutants into water bodies[9]. The purpose is to deal with the issues of water shortage and water pollution, which are aggravated by the population increase and rapid economic development.

28. Following this, the State Council issued the National 12 FYP for Construction of Urban Wastewater Treatment and Reuse Facilities in April 2012, establishing targets for wastewater collection, treatment, and reuse by 2015.

[9] Mr. HU Siyi, PRC Vice Minister of Water Resources, 16 February 2012, "Speech at the Press Conference of the State Council Information Office" http://www.china.org.cn/china/2012-02/17/content_24664293.htm

Table 4: Urban Wastewater Treatment and Reuse Targets for 2015

Parameter			2010	2015 Target
Wastewater Treatment Rate (%)	Designated Cities		77.5%	85%
	Of Which:	36 Key Cities [1]		100%
		Prefecture-Level City		85%
		County-Level City		70%
	County Town		60.1	70%
	Designated Towns		<20%	30%
Volume of Sludge Safely Disposed (%) [2]	Designated Cities		<25%	70%
	Of which: 36 Key Cities			80%
	County-Town			30%
	Designated Town			30%
Wastewater Reuse Rate (%)			<10%	15%
Total Length of Sewers (thousand km)			166	325
Wastewater Treatment Capacity (million m^3/d)			124.76	208.05[3]
Treatment Upgrades (million m^3/d of plant capacity)				26.11 additional
Sludge Treatment Capacity (million tons/year dry sludge)				5.18 additional
Wastewater Reclamation Capacity (million m^3/d)			12.10	38.85
WWTP Utilization Rate (%)	After 1 year of operation			≥ 60%
	After 3 years of operation			≥ 75%
Total Investment				~CNY430 billion

Source: National 12 FYP for Construction of Urban Wastewater Treatment and Reuse Facilities
http://wenku.baidu.com/link?url=LI7Jdq1ImKFAV8W9g-AbAhVij7GAxdkPRt4Bf-zJTtNFDNiuMnMeHjZZ7aWXt5p4-5rK1Um5tojnSuHF8rDxeNe4U_KDLhRQJjbbus90oLK

1. 36 key cities includes the 4 directly-administered municipalities (Beijing, Shanghai, Chongqing, and Tianjin), 5 open door cities (Dalian, Qingdao, Ningbo, Xiamen, and Shenzhen), and 27 provincial capitals.
2. Safe Disposal of Wastewater Sludge is an environmentally reliable procedure, for example composting, incineration with air pollution control equipment, burial in a sanitary landfill with leachate collection system, etc.
3. Includes the 37.6 million m^3/d capacity under construction during 2010.

29. According to the 12 FYP, improvements to the urban wastewater system between 2010 and 2015 will focus on the following aspects:

Wastewater collection system improvements – Expansion of the collection system by 159,000 km, focusing on designated cities in the Central and Western Regions and towns in the developed Eastern Region. In addition, cities with abundant rainfall are required to construct separate storm and sanitary sewer systems in newly developed areas and to replace combined sewer systems in existing areas where possible. Storage of the first flush during rain events and subsequent treatment at WWTPs is also encouraged.

Wastewater treatment capacity improvements – Expansion of the urban wastewater treatment capacity by 45.69 million m^3/day, focusing on cities and towns currently without centralized treatment. WWTPs discharging in key watersheds, source waters, and other sensitive water bodies are required to employ nutrient removal technologies. In towns located in areas that are not "environmentally sensitive", decentralized, low cost, and easy to operate treatment processes are permitted, and the use of ecological or natural treatment processes are encouraged.

WWTP process upgrades – Upgrade existing WWTPs (total capacity of 26.11 million m^3/day) to include biological (secondary) treatment processes and nutrient removal capabilities, focusing on WWTPs located in cities, key watersheds, and key source waters, and other environmentally sensitive areas. See Table 5 for PRC discharge standards.

Construction of sludge treatment and disposal facilities – Increase sludge treatment and disposal capacity by 5.18 million tons/year (dry sludge), with more economically developed areas taking the lead. This includes primary sludge, waste activated sludge, and mixed sludge. Principles of quantity minimization and stabilization should be adopted. Treatment through anaerobic digestion or aerobic fermentation is encouraged, followed by disposal methods that

maximize energy and resource recovery from the sludge, such as land application, co-incineration in cement kilns or coal-fired power plants.

Promote wastewater reuse – Expand wastewater reuse capacity throughout the PRC by 26.76 million m^3/day, focusing on regions with low water availability per capita (e.g. northern China), high water consumption per unit GDP, or high water usage. Users requiring large volumes of reclaimed water at relatively low water quality standards should be identified and prioritized.

- **Operational and regulatory improvements** – Construct 215 discharge monitoring stations at the national, provincial, and municipal levels to improve monitoring of various water quality parameters.

Table 5: PRC GB 18918-2002
Maximum Allowable Concentrations[10] of General Control Parameters for WWTP
(Daily Average)

Number	General Control Parameter		Grade 1, mg/L		Grade 2	Grade 3
			A	B	mg/L	mg/L
1	COD		50	60	100	120①
2	BOD_5		10	20	30	60①
3	SS		10	20	30	50
4	Oil and Grease		1	3	5	20
5	Petroleum Oil		1	3	5	15
6	LAS		0.5	1	2	5
7	Total N (as nitrogen)		15	20	-	-
8	NH_3-N (as Nitrogen)		5 (8)	8 (15)	25 (30)	-
9	Total P (as P)	Built before 31 December 2005	1	1.5	3	5
		Built after 1 January 2006	0.5	1	3	5
10	Color (time of dilution)					
11	pH					
12	Fecal Coliform (number/L)		103	104	104	-

1. Requirement for removal rate in the following cases: removal rate shall be higher than 60% when influent COD is more than 350 mg/L; removal rate shall be higher than 50% when influent BOD is more than 160 mg/L.
2. For NH_3-N data outside brackets are applied to water temperature higher than 12 degree Celsius (^oC), while data in brackets are applied to water temperature at or lower than 12^oC.

30. Additional targets in the 12 FYP relevant to wastewater are shown in Table 6. These targets are relevant for treatment of municipal and industrial wastewater, as well as reduction of nonpoint source pollution such as runoff from agricultural land.

[10] Grade 1A standards are required for WWTPs discharging into nationally or provincially identified watersheds, lakes, reservoirs, and other enclosed water bodies. Grade 1B standards are applied to WWTPs discharging into Class III water function zones, as defined by GB3838, or Class II ocean water function zones, as defined by GB3097, with the exception of source water protection zones and areas designated for swimming. Grade 2 standards apply for WWTPs discharging into Class IV or V water function zones (GB3838) or Class III or IV ocean water function zones (GB3097). Grade 3 standards apply for WWTPs in designated towns outside of key watersheds or drinking water sources and use only primary treatment.

Table 6: Targets in the 12 FYP

Parameter	Target by 2015
Chemical Oxygen Demand (COD) reduction	-8%
Ammonia-nitrogen reduction	-10%
Five heavy metals' reduction – lead, mercury, chromium, cadmium and arsenic (new)	-15% from 2007
Water intensity (water consumed per unit of value-added industrial output) reduction	-30%
Non-fossil fuels' proportion of primary energy mix	11.4%

31. **Urban transport**. The PRC's rapid urbanization presents significant challenges, including the need to build and upgrade roads, bridges, and other municipal infrastructure. Rapidly growing vehicle ownership, increasing road accidents, and the lack of traffic and parking management system compound problems in the urban transport sector. Key challenges are: (i) road safety requires wider public awareness, transport facilities designed considering road safety, and the enforcement of traffic safety regulations; (ii) public transportation and nonmotorized transport (NMT) systems should be fully integrated in urban transport planning and network design; (iii) the existing road networks in most small and medium-sized cities in the PRC are poorly maintained because maintenance systems are inefficiently managed and allocations of financial, technical, and human resources are inadequate; and (iv) parking in most small- and medium-sized cities in the PRC is poorly planned and regulated, with vehicles parked on sidewalks and in NMT lanes.

32. **Traffic accidents.** The total number of road traffic accidents in the PRC increased sharply during the period from 1990s to the beginning of 2000s due to the rapid development of the car industry and the lag of transport infrastructure and management development. Since 2003, the total number of accidents in the PRC has reduced because of the development of road transport safety infrastructure and the improvement of traffic safety management. Detailed statistics can be seen in Table 7; and developing trend of the number can be seen in Figure 8.

Table 7: Statistics of road traffic accidents in the PRC (1998-2012)

Year	Number of accidents	Number of fatalities	Number of injuries
1998	346,129	78,067	222,721
1999	412,860	83,529	286,080
2000	616,971	93,853	418,721
2001	754,919	105,930	546,485
2002	773,137	109,381	562,074
2003	667,507	104,372	494,174
2004	517,889	107,077	480,864
2005	450,254	98,738	469,911
2006	378,731	89,455	431,139
2007	327,209	81,649	380,442
2008	265,204	73,484	304,919
2009	238,351	67,759	275,125
2010	219,521	65,225	254,075
2011	210,812	62,387	237,421
2012	204,196	59,997	224,327

Source: Statistics from the Traffic Management Bureau of the Ministry of Public Security

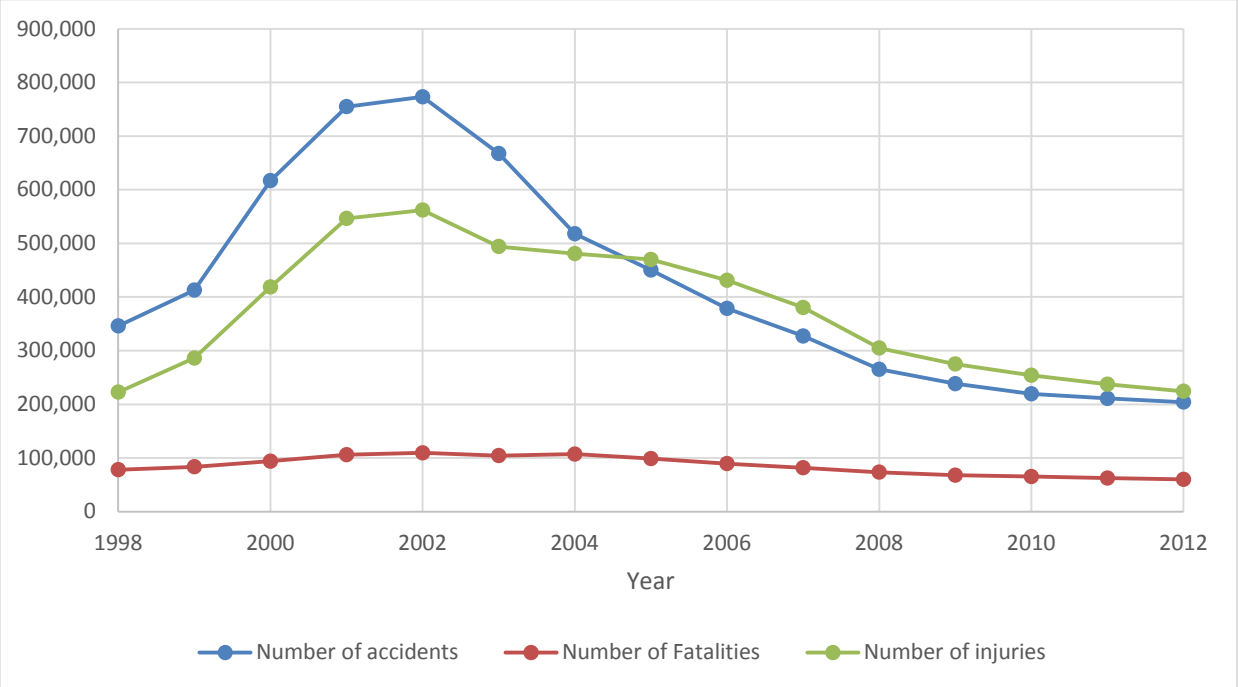


Figure 8: Developing trend of number of road accidents in the PRC

33. **Traffic congestion.** Till the end of 2013, the total vehicle ownership in the PRC reached 250 million, 137 million of which were cars. The increase of vehicle numbers in urban areas is especially obvious, with 23 cities each having more than 1 million vehicles. Traffic congestion has started appearing in all 36 central cities, and is becoming increasingly serious. Additionally, traffic congestion has stretched into outer areas of the central cities, and has appeared in small- and medium-sized cities.

34. **Public transport.** Till the end of 2012, there were 475,000 public buses in operation (equal to 528,000 standard bus units), which was 4.8% (5.7%) more than 2011. In 2012, there were 38,000 bus lines, with a total network length of 715,000 km. The total passenger volume was 74.98 billion person trips, 61.1% of the total urban passenger transport volume. Till the end of 2012, there were 285,000 public buses equipped with global positioning system (GPS) terminals, which was 60.1% of the entire vehicle fleet in operation. However, due to the worsening traffic conditions in cities and the lag in the development of advanced operation methods, many urban bus systems are suffering from overload, unpunctuality, high energy consumption and pollution which are harming the attractiveness of public transport." (Source: Ministry of Transport. 2012. *National Report on Urban Passenger Transport Development*)

35. **Intelligent transport system (ITS)** is an integrated transport and management system which is real-time, accurate and efficient. It plays a role of human-vehicle-road coordinator in a wide range of space and time. It applies advanced information, data transmission, electronic sensing, electronic control and computer processing technologies.

36. In 1994, the PRC began to pay attention to the ITS development situations worldwide. Since 1995, the research on ITS and international cooperation on ITS has increased. From 1996, the PRC established ITS research centers in the Ministry of Science and Technology, the Ministry of Transport and the Ministry of Railway, and formed a governmental ITS coordination group and later the Intelligent Transportation Society. At the same time, big cities such as Beijing, Xi'an, Shanghai, Wuhan and Hangzhou proposed their ITS schemes and implementation plans. The applications of ITS in the PRC currently focus on: (i) Urban Traffic Control System (UTCS); (ii) Freeway Surveillance and Control System; (iii) Electronic Toll Collection (ETC); (iv) Electronic Route Guidance System (ERGS); (v) Public transport operation management; (vi) Traffic safety and emergency management; and (vii) Transport information construction. Intelligent urban bus system, as a subsystem of ITS, is the focal point of the PRC's current transportation development.

1.2 Overview of Gansu Province

37. **Water and sanitation.** Gansu Province has a land area of 454,000 km^2 and the vast majority of its land is more than 1,000 meters above sea level. The province is mountainous in the south (Qilian Mountains) and flat in the north.[11] In addition to mountains and plateaus there are valleys and deserts. Much of the land is unsuitable for agricultural crops.

38. The water resources in Gansu are mainly distributed in nine river systems in the Yellow River, Yangtze River, and inland river drainage basins. To date, 29 hydropower stations have been constructed in the province with an installed generating capacity of 30 million kW and an annual output of 23.565 billion kWh[12]. Nevertheless many locations suffer from water shortage due to distance from the rivers and irregular rainfall although rainwater harvesting in some areas has been successful.[13]

39. The Yellow River passes through the southern part of the province and is the water source for Lanzhou, the provincial capital and its largest city, and Baiyin municipality. The Yellow River in this area has adequate flow and there are no issues of adequate source of water in locations close to the River.

40. Until 2012, the total volume of water supply is about 12,310 million m^3 for Gansu Province. Among this, the ratio of water usage for agricultural, industrial, domestic and ecological uses is 77.25%, 12.75%, 7.55%, and 2.4% respectively. The average water usage is 478.4 m^3/person/year (PRC Statistical Yearbook 2013).

[11] http://en.wikipedia.org/wiki/Gansu#Geography
[12] http://www.china.org.cn/e-xibu/2JI/3JI/gansu/guansu-ban.htm
[13] http://www.rainwaterharvesting.org/international/china.htm

41. The water supply distribution system in villages is not well developed and Gansu Province is providing funds for village water supply improvements through the "1236 policy".

42. Use of incompletely treated wastewater for irrigation of agricultural crops is common and is alleged as cause of human health ailments in some areas due to contamination by heavy metals such as cadmium[14]. Considering the Province's geology and large concentrations of non-ferrous metals it is likely the land is as much a source of heavy metal contamination as is improperly treated wastewater.

43. ADB is financing wastewater system improvements[15] in Jiuquan Municipality, located about 730 kilometers (km) northwest of Lanzhou. Excessive wastewater overflows discharge into the Beida River. The Project expands the wastewater collection and treatment system to serve broader coverage in the existing and expanded urban areas raising the treatment rate from 66% to 88%.

44. **Road and industrial development.** Gansu's gross domestic product per capita ranked second-to-last among all the PRC provinces, autonomous regions, and municipalities. The economic development of the Western Region lags because of the harsh climate, underdeveloped transport and urban infrastructure, and lack of investment. Thanks to its relative short distance from Lanzhou, Baiyin's integration into Lanzhou's economy has become imperative. The project supports the PRC's 12 FYP and the Urban Master plan for Baiyin, which prioritizes economic development, environmental protection, and ecologically friendly urbanization.

45. During the 11 FYP, Gansu Province achieved accumulative investment of CNY84.2 billion in the transport sector, of which CNY14.2 billion was spent on road network improvement, CNY20.1 billion on rural road construction, and CNY8.2 billion on highway and waterway transport facility improvement. They represent 2.1, 0.9, and 3.7 fold increases respectively compared with the 10 FYP. The total length of motorway in the province reached 2,000 km, of which 986 km long motorway was built during the 11 FYP.

46. For the 12 FYP, the Province faces new challenges and opportunities. With the recovery of the global economy and rapid globalized economic trend, the PRC's economy maintains steady growth. The need for high quality transport infrastructure integrating into more advanced transport network in the Eastern Region becomes more acute. Synchronization of urbanization with industrialization will address the urban-rural gap, land use and imbalanced industrial development etc. Transport development is envisaged as precedence and cornerstone for social and economic development. However, the transport sector faces stringent needs for reform and transition from mounting transport infrastructure investment over the past decades to improve levels of service quality.

47. **Traffic accidents.** The number of road traffic accidents in Gansu Province has decreased since 2003. In 2006, the number of road traffic accidents in Gansu was 4,822, which had reduced by 8.9% from the previous year. In the first month of 2013, 385 road accidents happened in the province. The number of accidents is steadily dropping. However, the number of serious road traffic accidents which involved 3 or more fatalities each has remained relatively large.

48. **Traffic congestion.** Since the economic development of Gansu Province has lagged behind provinces in Eastern China, the degree of population aggregation is not high and urban

[14] http://www.marketwatch.com/story/the-poison-eaters-of-chinas-gansu-province-2013-03-03
[15] ADB RRP for Gansu Jiuquan Integrated Urban Environment Improvement Project Number: 45506, May 2013 http://www.adb.org/sites/default/files/projdocs/2013/45506-002-prc-rrp.pdf

development is relatively slow. Except for the capital, Lanzhou, there is no obvious or serious traffic congestion in the major cities of Gansu Province.

49. **Public transport.** Gansu Province has 4,506 public buses, with 4,312 of them in operation on 425 lines. 1,165 vehicles are equipped with GPS positioning terminals and represent 19.1% of the entire fleet. [4] The development of public transport in Gansu falls behind that in provinces in Eastern and Southern China. In cities like Lanzhou, suffering from serious traffic congestion, the local government is making efforts to prioritize the development of urban public transport by increasing investments into both infrastructure and operation.

50. **ITS.** Gansu Province, as a province in the Western Region, is not a leader in the development of ITS. However, cities and towns in the province are developing ITS according to their own needs. Lanzhou, as the capital of the province and a city suffering from serious traffic congestion, is the most well developed in ITS. Lanzhou has built its off-site traffic law enforcement system based on Internet of Things (IOT), and a public transport information platform with "2 main systems and 13 sub-systems". Other cities of Gansu Province, including Baiyin, Pingliang, and Wuwei, etc., are making efforts to improve the ITS infrastructure and build economical and practical ITS to meet their demands in transport management.

1.3 Overview of Baiyin Municipality

51. **Water and sanitation.** The source of the following is Baiyin Statistical Yearbook 2013, which compiled data as of the end of 2012.

Table 8: Urban construction

Index		Unit	Baiyin Municipality	Jingyuan County
Level of utilities				
Daily water consumption per capita		liter	142.48	81.32
Water use penetration rate		%	99.56	99.89
Density of drainage pipes in built-up areas		km/km^2	2.94	5.66
Urban road area per capita		m^2	13.47	12.65
Wastewater treatment rate		%	58.57	0.78
Utilities				
Water supply production capacity		10,000 cubic meters / day	50.42	0.98
Total water supply quantity		10,000 cubic meters	7335.34	363.1
Of which:	Water use for production operation	10,000 cubic meters	2551.91	47.9
	Household water consumption	10,000 cubic meters	3328.91	199.32
Population using water		10,000 people	67.81	8.74

Table 9: Urban environmental protection

Item	Unit	2012
Industrial wastewater		
Industrial water reuse rate	%	83
Industrial solid waste		
Comprehensive utilization rate of industrial solid waste	%	50

Table 10: Urban domestic and other pollution

Item	Unit	2012
Basic situation		
Total population	10,000 people	174.3
# Non-agricultural population in urban areas	10,000 people	48.02
Number of WWTPs	Number	4
Pollution discharges		
Urban domestic wastewater discharge coefficient	kg/person-day	103.34
COD generation coefficient in urban domestic wastewater	g/person-day	59
Ammoniacal nitrogen generation coefficient in urban domestic wastewater	g/person-day	8

52. **Road and industrial area development.** There are several existing development zones in Baiyin. Baiyin Hi-tech Zone and Pingchuan Economic Zone have been in full-fledged development since the year of 2000. Infrastructure and regional transport conditions have been substantially improved. These have laid solid foundation for further development and lessons have been learnt that can be applied to other development zones. Under the industrial development plan prepared by Baiyin Municipal DRC, there are a total of 13 development zones, of which one is a national-level zone, and two are provincial-level zones.

53. In the ADB Baiyin Phase I project, the Southern Baiyin infrastructure component developed additional 6 km^2 of industrial land south of Baiyin. The Baiyin and Pingchuan road improvement components constructed new roads and improved existing roads in the urban areas in both districts. These provided necessary facilities for business and production, for improving the urban traffic condition and living standards, and for improving the overall investment environment.

54. **Road accidents.** In Baiyin, the number of road accidents increased by 1.7% from 1,211 in 2010 to 1,232 in 2013 (in which major accidents, the ones that cause injuries and property losses, increased by 94.3% from 35 to 68).

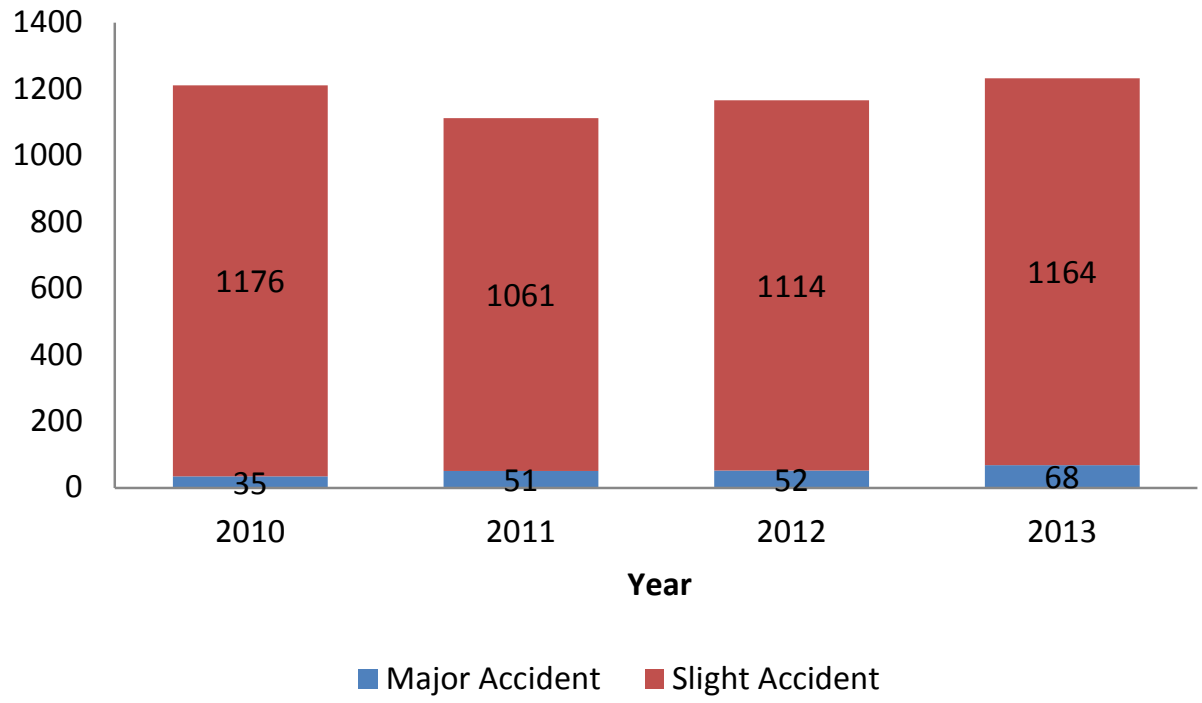


Figure 9: Number of road accidents in Baiyin

55. **Traffic congestion.** The daily average vehicle speed on major roads of Baiyin District is 36.94 km/h. During morning, noon and evening peak hours, the average vehicle speeds on major roads are 35.59 km/h, 33.65 km/h and 33.53 km/h respectively. At present, there is no serious traffic congestion in Baiyin District, but minor- and medium-level congestion has appeared in some nodes and sections during noon and evening peak hours, as well as the weekends.

56. **Public transport.** There are currently 200 buses serving Baiyin District on 13 lines. The total length of operating bus lines is 36 thousand km. The daily passenger volume is 130,000 person trips. The bus vehicle ownership is 4.21 standard units per 10 thousand people. The bus lines have covered most urban roads in Baiyin District. Large capacity buses, dual-fuel and low-emission buses accounted for over 87% of the total. The IC bus card system was

established in 2008, and is also connected with other 33 cities in the PRC including Lanzhou. Public transport service in Baiyin received relatively high satisfactory comments from its users; but the old bus system will not be strong enough to deal with the rapidly increasing travel demand brought about by economic development and population growth. Hardware and software both need to be upgraded.

57. **ITS.** Transportation in Baiyin District is rapidly developing, with its population, car ownership and infrastructure construction also increasing. The current traffic management systems and facilities will not meet future demand. At present, Baiyin District's ITS faces three major problems: (i) the lack of traffic information infrastructure, which cannot provide traffic managers timely and accurate information and data; (ii) the separation of intelligent traffic management systems, which has a negative influence on the managers' scientific and rational decision-making; (iii) the lack of intelligent management measures for public transport, which prevents the effective utilization of public transport resources and the achievement of travel information service.

Table 11: Some sector statistics of the PRC

		2001	2005	2010	2012
PRC population	0000	*127,627*	*130,756*	*134,091*	*135,404*
PRC urban population	0000	48,064	56,212	66,978	71,182
%		38	43	50	53
Water					
Urban Water Supply Capacity	0000 m^3/d	22,900	24,720	27,602	27,177
	Per capita	0.48	0.44	0.41	0.38
Water Supply Volume capacity	0000 m^3/year	8,358,500	9,022,727	10,074,548	9,919,715
Urban water supply pipelines	km	289,338	379,332	539,778	591,872
	Per 0000 capita	6.0	6.7	8.1	8.3
Water supply volume	0000 m^3/year	4,661,194	5,020,601	5,078,745	5,230,326
	Operation rate %	56%	56%	50%	53%
Residents with access	0000 persons	25,833	32,723	38,157	41,027
	% urban population	54%	58%	57%	58%
Wastewater					
Urban wastewater treatment capacity	0000 m^3/d	6,215	7,990	13,393	13,693
	Per capita	0.13	0.14	0.20	0.19
Urban wastewater pipelines	km	158,128	241,056	369,553	439,080
	Per 000 capita	3.3	4.3	5.5	6.2
Road					
Road Length		176,016	247,015	294,443	327,081
	Per 0000 capita	3.7	4.4	4.4	4.6

Table 12: Some sector statistics of Gansu Province

		2001	2005	2010	2012
Gansu population	0000 persons	*2,523*	*2,545*	*2,560*	*2,578*
Gansu urban population			764	925	999
%			30	36	39
Water					
Urban Water Supply Capacity	0000 m^3/d	348	369	398	370
	Per capita		0.48	0.43	0.37
Water Supply Volume capacity	0000 m^3/year	127,020	134,649	145,343	135,196
Urban water supply pipelines	km	4,235	5,521	4,357	4,719
	Per 0000 capita		7.2	4.7	4.7
Water supply volume	0000 m^3/year	73,761	59,810	62,713	54,243
	Operation rate %		44%	43%	40%
Residents with access	0000 persons	381	440	495	524
	% urban population		58%	54%	52%
Wastewater					
Urban wastewater treatment capacity	0000 m^3/d	38	73	108	159
	Per capita		0.10	0.12	0.16
Urban wastewater pipelines	km	2,215	2,722	3,092	3,282
	Per 000 capita		3.6	3.3	3.3
Road					
Road Length		2,444	2,960	3,399	3,580
	Per 0000 capita		3.9	3.7	3.6

2. Government Sector Strategy

2.1 PRC overall policy and strategy

58. **Road and industrial area development.** Recently, at the national policy level, 'Silk Road economic corridor' and 'synchronized urbanization and industrialization' are on the top agenda of the central government. Lanzhou is positioned at the focal point along the 'Silk Road', and its strategic importance in the Western Region is prevailing. With the integration of Lanzhou and Baiyin, Baiyin will be developed as a sub-urban center of Lanzhou. These policies bring about opportunities for Baiyin to develop its industries and upgrade its infrastructure.

59. Ministry of Transport prepared the 12 FYP according to the sector context and development trends. The key strategies for the highway sector include upgrade/completion of highway network, strengthening of road maintenance, and improvement of highway transport service level and sector management capacity. On the integrated transport service, the key objectives are to strengthen multi-modal transfer; facilitate modern logistics development; enhance urban passenger transport management and increase transport service capacity and its reliability. In the urban transport sector, low-emission, efficient and green public transport is becoming a major driver for development.

60. **ITS.** On 15 December 2011, the Ministry of Transportation issued the 12th Five-year Development Plan for Road Transport, which made it clear that in the 12 FYP, the PRC will "promote transport information technology and ITS development to enhance the level of modernization of transport" following a "moderately advanced" principle. In recent years, the CAGR of the investment to ITS development has been over 20%. Throughout the next three years, it is expected that domestic investment in the ITS industry will exceed CNY150 billion. Meanwhile, ITS is an important part of "Smart City", and the PRC's investments in ITS has gradually increased. Its development will have good prospects and good market in terms of both demand and policy support.

61. The future policies will support: (i) urban ITS development; (ii) highway and urban public transport information development; (iii) cooperation of ITS and new information technologies; and (iv) integration and multisectoral drive of ITS development.

62. **TVET.** Development of TVET is one of the top 10 priorities under the government's 12 FYP and specified in the National Long-term Strategy on Education (2010-2020), which calls for increased investment in the sub-sector and sets out TVET targets/objectives to be achieved by 2020. Main policy directions for development of TVET identified for funding and technical support in state and provincial plans include:

- Expansion of secondary and tertiary level TVET to meet a 1:1 ratio with secondary and higher education enrolment;
- Building capacities for administration and management of TVET at both macro and micro levels;
- Improved access, coordination and mobility between tertiary and secondary TVET, as well as between TVET and general and higher education;
- Innovation in development of curricula and alignment of educational standards with practical employment needs;
- Increasing the quantity and quality of teaching personnel, to include practical experience and improved classroom skills;
- Strengthening opportunities for continuing education and training in the context of lifelong learning;
- Building cooperation between TVET institutions and enterprises; and
- Increasing availability of resources and upgrading school facilities and equipment.

2.2 Gansu Provincial policy and strategy

63. **Road and industrial area development.** The preferential policies given to the Western Region has brought new opportunities to Baiyin. The central and provincial governments greatly support Baiyin's industrial transformation. Baiyin needs to strengthen its reform and openness to the outside world, actively improve the investment environment, and address its infrastructure weakness. Relying on local rich natural resources and labor resources, Baiyin will need to develop an inclusive and a distinctive development path. In response to the development policy and strategy of Lanzhou-Baiyin Economic Integration, its industrial parks will be developed along the trunk transport corridor of G6 Expressway. As one of the latest and largest industrial parks, Liuchuan Industrial Park (LIP) has the potential to become the new economic growth hotspot.

64. **ITS.** The 12 FYP for Gansu Transport Development targeted that during this period, Gansu Province would "promote the construction and application of information technology" with the construction and application of "4 systems and 1 platform" as the core work content. The "4 systems" are (i) the transport administration and service system based on e-governance; (ii) the travel information service system led by IOT; (iii) the transport emergency responding and safeguard system supported by sensing and related technologies; and (iv) the transport economic operation monitoring, early warning and decision analysis system. The "1 platform" is the transportation industry market credit information service platform.

65. At the same time, Gansu Province will gradually improve the supporting capacity of transport information infrastructure by improving: (i) the transport information infrastructure and communications networks; (ii) the transport database service capacity; (iii) the transport industry standard framework and data sharing capacity; and (iv) the transport industry security system and information defensive capability.

2.3 Baiyin Municipal policy and strategy

66. **Road and Industrial area development.** Baiyin Municipal Government (BMG) approved the establishment of LIP in 2007. The park's short-term plan covers an area of 23 km^2; its long-term plan covers an area of 100 km^2. The industrial park is positioned to serve major

industries including rare earth, non-ferrous metal processing, equipment manufacturing and warehousing and logistics etc.

67. Approved by the provincial government in 2010, the Baiyin Urban Master Plan was updated with new features. The urban planning scope has been extended further east to Liuchuan Township. LIP will be the focal point for future industrial development and will be a demonstration for circular industry economy. The master plan of LIP covering 50 square kilometers has been completed, positioning this as the key economic zone for the next decade.

68. LIP is located in Jingyuan County, the east of Baiyin urban area. The area is spacious, has little value for farming and is close to water sources and power supply. It is a favorable location for industrial zone development. However, to enable large-scale industrial development, the site is in urgent need of infrastructure such as road access, water supply and wastewater treatment. Provision of infrastructure will contribute to the overall ecological environment improvement of the upper reaches of Yellow River within the county proper.

69. **ITS.** Baiyin has established the 12 FYP for Urban Construction, Road and Waterway Construction, Industry and Information Development. However, there is currently no specific 12 FYP for Transport and ITS development. Baiyin now follows the guidance of the provincial plan and national plan for transport development and the relevant clauses on ITS development. BMG shows a strong desire to promote ITS development because the development of intelligent transport management tools cannot catch up with the development of transport infrastructure in Baiyin. The current development of ITS in Baiyin is still in its infancy. Therefore, future development of ITS still calls for more and stronger policy support from the local government.

70. **TVET.** Within Baiyin Municipality and Jingyuan County, and within the context of the project component in LIP in particular, priority areas can be summarized as follows:

- Ensuring availability of skilled and semi-skilled labor to meet the needs of enterprises to be located within the LIP by 2019;
- Promoting the development of livelihoods for laid-off workers and surplus labor in Jingyuan County, including those displaced by the LIP development, and decreasing rural/urban inequities;
- Ensuring provision of access to and opportunities for TVET in subject areas and at appropriate qualifications levels to meet the needs of a transformed economy;
- Strengthened sector planning, to include an increased market-orientation and use of improved labor market information;
- Increasing the efficiency and effectiveness of local government institutions with responsibilities for TVET and clarification of their roles and responsibilities.

71. The proposed TVET component of the project will support the national and provincial reform agendas while allowing scope for local level initiatives, in particular through innovative partnerships between TVET institutions and industry.

3. ADB Sector Experience and Assistance Program

72. Since 1992, ADB has invested about $5.7 billion in 49 urban development and environment improvement projects in the PRC. ADB has been actively supporting the PRC development initiative and the WDS, focusing on the provision of infrastructure and environmental management to lay a foundation for sustainable socioeconomic development. This project will be ADB's sixth urban development project in Gansu province [16] and the second

[16] ADB. 2008. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Gansu Baiyin Urban Development Project*. Manila ($80 million, Loan 2407-PRC); ADB. 2009. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Lanzhou Sustainable Urban Transport Project*, Manila ($150 million, Loan 2601-PRC); ADB.

foreign-financed urban development project in Baiyin. ADB assistance to the urban sector has been effective in redressing a range of urban development challenges and environmental problems. Experience suggests that project investments and technical assistance interventions are effective when they are part of well-conceived and broader urban development plans and approaches. Lessons from previous urban development projects as well as the knowledge generated from various policy-oriented studies are reflected in the project design, including water and wastewater management and sustainable transport.

73. Support for TVET and related employment issues has been a central theme of ADB's national program in the PRC. TVET remains a priority area for investment under the current national program, with related PPTA concurrent in Shanxi and Guangxi Provinces, with a TVET Demonstration project currently being finalized in Hunan Province. Incorporation of TVET elements into the Baiyin Urban Development programs signals an innovative and complementary action in support of local communities impacted by the LIP development.

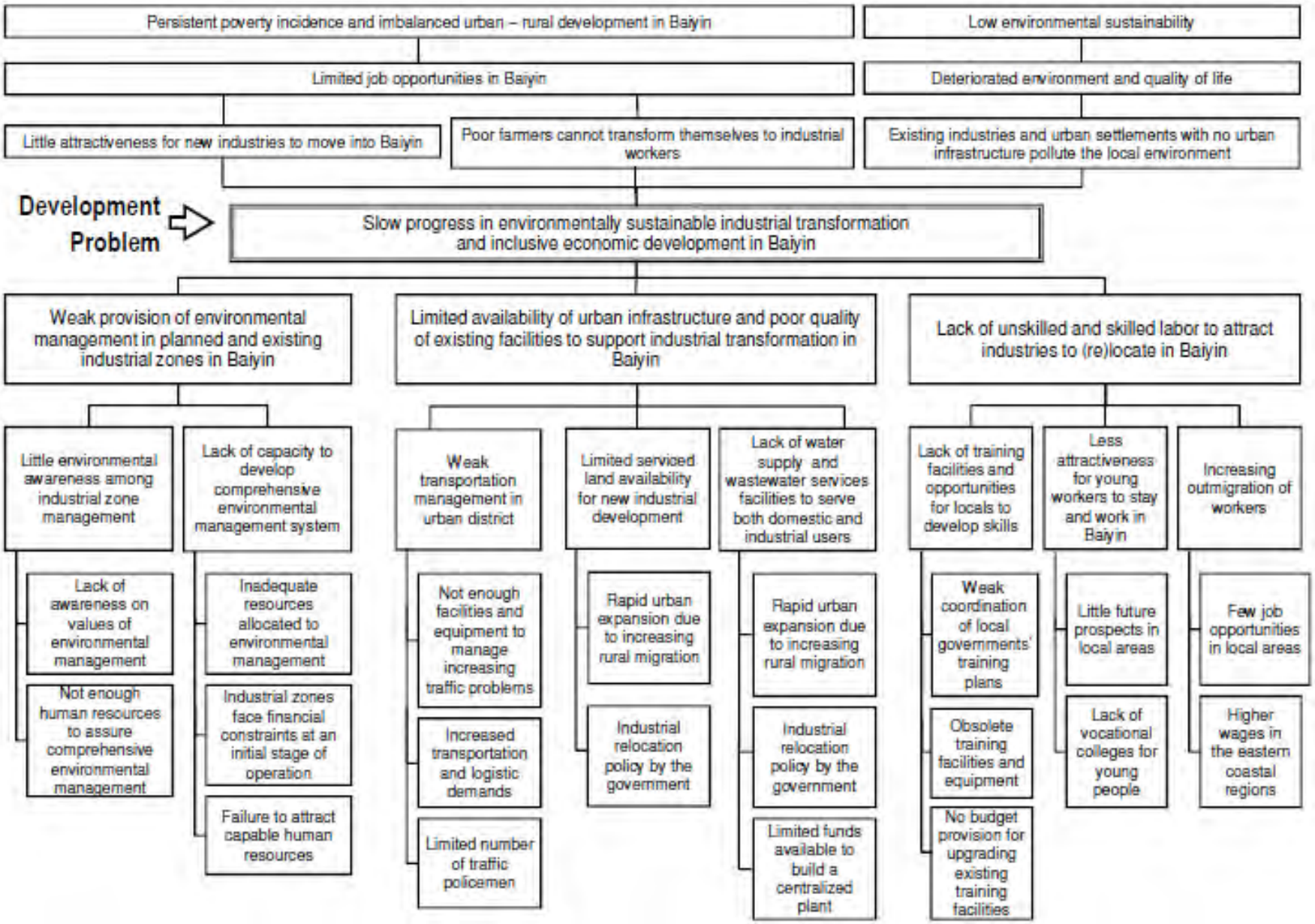
74. The project will contribute to promoting balanced regional development in the PRC, thereby supporting the national 12 FYP. By promoting sustainable and environment-friendly urban development, the project aligns with ADB's country partnership strategy for the PRC.[17] It contributes to Millennium Development Goal 7 by improving water and sanitation. It conforms to ADB's urban, water and transport sector strategies, which encourages green, competitive and inclusive urban development, efficient water use, expanded wastewater management, and sustainable urban transport.[18]

75. In line with the 12 FYP, ADB will strengthen its support for improving social inclusion and municipal and social service provision, including support for skills development, with an emphasis on TVET development, to prepare a skilled labor force for the ongoing urbanization, in dealing with the social and gender dimensions of inequality, poverty reduction, private sector development, and economic restructuring.

2011. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Gansu Tianshui Urban Infrastructure Development Project*. Manila ($100 million, Loan 2760-PRC); ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Gansu Urban Infrastructure Development and Wetland Protection Project*. Manila ($100 million, Loan 2903-PRC); and ADB. 2013. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Gansu Jiuquan Integrated Urban Environment Improvement Project*. Manila ($100 million, Loan 3003-PRC).

[17] ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015*. Manila.

[18] ADB. 2012. *Urban Operational Plan2011-2020*. Manila. ADB. 2011. *Water Operational Plan2011-2020*. Manila. ADB. 2010. *Sustainable Transport Initiative: Operational Plan*. Manila


Persistent poverty incidence and imbalanced urban – rural development in Baiyin
Low environmental sustainability
Limited job opportunities in Baiyin
Deteriorated environment and quality of life
Little attractiveness for new industries to move into Baiyin
Poor farmers cannot transform themselves to industrial workers
Existing industries and urban settlements with no urban infrastructure pollute the local environment
Development Problem
Slow progress in environmentally sustainable industrial transformation and inclusive economic development in Baiyin
Weak provision of environmental management in planned and existing industrial zones in Baiyin
Limited availability of urban infrastructure and poor quality of existing facilities to support industrial transformation in Baiyin
Lack of unskilled and skilled labor to attract industries to (re)locate in Baiyin
Little environmental awareness among industrial zone management
Lack of capacity to develop comprehensive environmental management system
Weak transportation management in urban district
Limited serviced land availability for new industrial development
Lack of water supply and wastewater services facilities to serve both domestic and industrial users
Lack of training facilities and opportunities for locals to develop skills
Less attractiveness for young workers to stay and work in Baiyin
Increasing outmigration of workers
Lack of awareness on values of environmental management
Not enough human resources to assure comprehensive environmental management
Inadequate resources allocated to environmental management
Industrial zones face financial constraints at an initial stage of operation
Failure to attract capable human resources
Not enough facilities and equipment to manage increasing traffic problems
Increased transportation and logistic demands
Limited number of traffic policemen
Rapid urban expansion due to increasing rural migration
Industrial relocation policy by the government
Rapid urban expansion due to increasing rural migration
Industrial relocation policy by the government
Limited funds available to build a centralized plant
Weak coordination of local governments' training plans
Obsolete training facilities and equipment
No budget provision for upgrading existing training facilities
Little future prospects in local areas
Lack of vocational colleges for young people
Few job opportunities in local areas
Higher wages in the eastern coastal regions

Sector Results Framework (Urban Development, 2011–2015)

Country Sector Outcome		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contributions	**Indicators with Targets and Baselines**	**Outputs with ADB Contributions**	**Indicators with Incremental Targets**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Contributions**
Competitive, green, and inclusive urbanization	Water supply and other municipal infrastructure and services: Urban population with access to piped water supply increased from 96% (2009) to 98% (2015) Urban population with access to improved sanitation increased from 58% (2008) to 65% (2015) Domestic solid waste treatment ratio increased from 71% (2010) to 80% (2015) **Education:** Number of students at secondary vocational schools increased from 21.79 million (2009) to 22.5 million (2015) (sex disaggregated) Number of students at postsecondary vocational schools increased from 12.8 million (2009) to 13.9 million (2015) (sex disaggregated)	Services expanded and improved Infrastructure and services expanded, improved, and well-managed	Treated water supply increased from 160 million m^3/day (2010) to 200 m^3/day (2015) Wastewater treatment increased from 150 million m^3/day (2010) to 180 m^3/day (2015) Number of enrolled students at secondary vocational schools increased by 710,000 by 2015 (Baseline: 21.79 million in 2009) Number of enrolled students at postsecondary vocational schools increased by 1.1 million by 2015 (Baseline: 12.8 million in 2009) Municipal and town governments' institutional and financing capacity improved	Planned key activity areas: Lending operations with a total investment of $1.9 billion in water supply, wastewater, solid waste management, heating, gas, urban transport, and river rehabilitation Nonlending programs in finance, environmental management, vocational education, and urban planning; knowledge products based on technical assistance findings and policy notes Planned projects (2012–2015) ($1.9 billion): Water supply and sanitation ($378 million) Urban transport ($593 million) Education ($108 million) Other municipal infrastructure and services ($821 million) Ongoing projects ($2,287 million): Water supply and sanitation ($895 million) Urban transport ($848 million) Education ($2 million) Other municipal infrastructure and services ($542 million)	Planned projects (2012–2015): Additional water and wastewater capacity (1,385,000 m^3/day) Additional urban roads built or upgraded (685 km) Additional vocational students enrolled (30,000) Ongoing projects: Additional water and wastewater capacity (2,654,000 m^3/day) Additional urban roads built or upgraded (927 km) Additional vocational students enrolled (5,000)

ADB = Asian Development Bank, km = kilometer, m^3/day = cubic meters per day.
Source: Asian Development Bank.

LINKED DOCUMENT 3
CONTRIBUTION TO THE ADB RESULTS FRAMEWORK

Number	Level 2 Results Framework Indicators (Outputs and Beneficiaries)	Targets	Methods / Comments
	Transport		
1	Provincial, district, and rural roads built or upgraded (km)	6	Urban roads
2	Use of roads built (average daily vehicle-km in the first full year of operation)	22,000	Projected traffic benefiting from urban roads built
	Water		
3	Water supply pipes installed or upgraded (length of network in km)	14	
4	Water treatment capacity added or improved (m^3/day)	60,000	One water treatment plant newly constructed
5	Wastewater pipes installed or upgraded (length of network in km)	46	The wastewater collection system will not be financed by the Loan, and will be financed by national government special funding source
6	Wastewater treatment capacity added or improved (in m^3/day)	35,000	One wastewater treatment plant newly constructed

km = kilometer, m^3/day = cubic meter per day.

Source: TA Consultant estimates

LINKED DOCUMENT 4
DEVELOPMENT COORDINATION

A. Major development partners: Strategic foci and key activities

1. The Asian Development Bank (ADB) began support for urban sector development in the People's Republic of China (PRC) in 1992. Of the 40 loans totaling $4.6 billion, five were for urban projects in Gansu Province targeting urban infrastructure, urban transport, wastewater, solid waste management, wetland protection, and urban environment improvement. The Gansu Baiyin Integrated Urban Development Project will be the second project financed by ADB in Baiyin.

2. Gansu Province has signed agreements with ADB, the World Bank, the International Fund for Agricultural Development, and foreign governments to borrow foreign loans for a total contracted amount of $3.8 billion for more than 160 projects involving infrastructure, expressways, forestry, health, education, hydropower, and cultural heritage protection. ADB has financed 14 projects in the areas of urban development, expressways, small hydropower, and forestry. ADB and the World Bank are the two main agencies supporting urban development. Bilateral agencies are providing smaller-scale and more sector-specific lending assistance.

Table 1: Major Development Partners

Development Partner	Project Name	Duration	Amount ($ million)
Multisector/Urban Development			
Asian Development Bank	Gansu Baiyin Urban Development	2007-2011	80.0
	Lanzhou Sustainable Urban Transport	2010-2015	150.0
	Gansu Tianshui Urban Infrastructure Development	2011-2016	100.0
	Gansu Urban Infrastructure Development and Wetland Protection	2012-2017	100.0
	Gansu Jiuquan Integrated Urban Environment Improvement	2013-2018	100.0
World Bank	Gansu Cultural and Natural Heritage Protection and Development	2008-2013	38.4
	Integrated Economic Development of Small Towns	2012-2017	150.0
	Gansu Qingyang Urban Infrastructure Improvement Project	2012-2017	100.0

Source: Asian Development Bank

B. Institutional Arrangements and Processes for Development Coordination

3. In the PRC, the central government mainly coordinates development assistance. All the development partners are requested to align their operations to support the implementation of a national development strategy as set out in the PRC's 12 FYP, 2011-2015 for social and economic development and approved by the People's Congress. Provincial and municipal governments are responsible for formulating their development plans in line with the national development strategy and ensuring that external assistance specific to the relevant provinces and municipalities supports the development needs outlined in their development plans without overlapping with each other.

4. ADB is committed to sharing sector information and experiences in partnership with its developing member countries and other development agencies. In line with its support for the 2005 Paris Declaration and the 2008 Accra Agenda for Action, ADB has been harmonizing its policies, procedures, and practices with its key development partners through parallel implementation structures, technical working groups, and joint missions. ADB actively supports and participates in periodic informal consultations to enhance dialogue and coordination among development partners. It also harnesses lessons from project design, implementation, and monitoring to be shared with other development partners.

C. Achievements and Issues

5. The strategies and operations of various development partners have many common elements because of their general alignment with the government's priorities. Major development partners' urban sector assistance has given greater focus to cities and towns in the less-developed central, western, and northeastern regions in support of the national development strategy for balanced regional development in the PRC. High priority is also accorded to making all cities livable by improving the urban environment, which includes efforts to improve urban infrastructure and services, reduce pollution, and improve land use.

6. Through coordination, ADB and other development partners have improved development synergies in redressing various urban development challenges and environmental problems by sharing knowledge and management experience. Coordination with major development partners has also been strengthened to support the PRC's FYPs, strategic master plans, public awareness and education, financial and institutional strengthening, and Millennium Development Goals.

7. Urbanization is taking place at an unprecedented pace and scale across the PRC and in cities and towns with different geographic conditions and at different stages of social and economic development. This will provide a rich source of knowledge and practices, as well as valuable lessons for future operations. Continued efforts will be needed to gain and share knowledge with the government and development partners to respond to the challenges of rapid urbanization and economic transformation.

D. Summary and Recommendations

8. The project team will coordinate with other development partners during project implementation. Strengthening development coordination in the PRC is expected to minimize transaction costs, maximize responsiveness, solve policy issues more systematically, provide greater support for institutional strengthening and capacity building, and increase accountability to achieve greater development impact.

LINKED DOCUMENT 5
FINANCIAL ANALYSIS

A. Introduction

1. The financial analysis is undertaken the proposed project in accordance with Asian Development Bank (ADB) guidelines.[1] Non-revenue generating subprojects and component include: (i) the TVET subproject, which will benefit skills development and labor employment of Baiyin municipality especially at Jingyuan County, (ii) the ITS subproject, which will improve road safety, reduce traffic violation and enhance public bus service in Baiyin District, and (iii) the road component under the Liuchuan industrial park infrastructure development subproject. Revenue generating components are the water supply and sanitation components under the Liuchuan industrial park infrastructure development subproject.[2] The financial analysis assessed (i) the financial viability of the revenue-generating water supply and sanitation component, and (ii) financial sustainability of two non-revenue-generating subprojects of TVET and ITS, and the road component under the Liuchuan industrial park infrastructure development subproject.

B. Financial Analysis of the water and sanitation components under the Liuchuan industrial park infrastructure development

a. Methodology

2. The financial internal rate of return (FIRR) was estimated for the water and sanitation component to assess the revenue generating capacity of the components to meet all cash requirements including investment and operation and maintenance (O&M) costs, and a reasonable rate of return on investment. The discounted cash flow approach is applied for the exercise and all costs and benefits are expressed real terms using March 2014 price levels. The weighted average cost of capital (WACC) based on financial assumptions was compared with the FIRR to ascertain the financial viability of the component. Sensitivity tests were undertaken to test the robustness of the FIRR to changes in underlying parameters, namely increases in capital and operating costs, low demand associated with reduction in revenue, and combination of these impacts. Project cash flow projections are based on the realistic estimation of water and sanitation tariffs, and assess whether cumulative cash flow will meet cash operating costs, debt service, and capital replacement, particularly of mechanical and electrical equipment. A single entity will be engaged as an operator for the water supply and sanitation services. Tariff affordability is also assessed to ensure tariff setting is within consumer ability-to-pay.

b. Financial assumptions

3. Financial projections of 25 years from project commencement to 20 years after project completion (cash flows) were prepared to determine the annual required revenue to ensure that the cumulative cash flow would meet cash operating costs, depreciation, and debt service. All costs are expressed in March 2014 prices. Cost streams used for calculating the FIRR are capital investment and O&M costs. Capital costs include the (i) base cost, including the investment cost for the associated water intake facility, primary and secondary water supply treatment facilities, water transfer pipelines, water and wastewater distribution pipelines and sludge handling equipment; and (ii) physical contingencies. O&M costs include personnel salaries, cost of chemicals and agents, utility cost (e.g. electricity), plant maintenance cost, administration, taxes, and other expenses.[3] Project revenue will be derived from water sales

[1] ADB. 2005. *Financial Management and Analysis of Projects*. Manila. ADB. 2009. *Financial Due Diligence: A Methodology Note*. Manila.
[2] A single entity will be engaged as an operator for water and wastewater services in Liuchuan industrial park.
[3] O&M cost for water is assumed at CNY1.03 per m^3 water produced in 2014 prices. For wastewater, O&M cost is CNY0.68 per m^3 of wastewater treated. This results in the total O&M cost at 6.5% of the total investment cost.

and wastewater treatment fees. The water and wastewater demand projections are based on: (i) water supply population of 38,848 in 2020 with daily water consumption per capita of 120 liters throughout the projection period for domestic use, (ii) industrial water demand based on type of industries and their typical daily water consumption based on the industrial demand assessment; and (iii) wastewater generation rate as 90% of water consumption.[4] Other assumptions include that (i) the ADB loan repayment period is 25 years including a 5-year grace period, and (ii) the baseline tariffs used to estimate the revenues are tariffs for domestic uses in Jingyuan County in 2013.[5] These tariffs are assumed to increase gradually every 3 years. The future tariff was projected carefully by making a conservative and realistic projection based on historical tariff revisions in Jingyuan County and Baiyin District. The analysis identified the financial viability of the water supply plant and the wastewater treatment plant to meet cash operating costs, to build up funds to cover capital replacement, and to pay debt service. The Liuchuan industrial park management committee will pay the debt service. Net cash flows were determined after income taxes were calculated at 25%. No residual value was assumed. The foreign exchange rate of CNY6.1 = $1.0 was used for the analysis.

c. Weighted Average Cost of Capital

4. The financing sources are assumed to comprise the Baiyin municipal government equity contribution, domestic bank loans and an ADB foreign currency loan. The Ministry of Finance of the People's Republic of China (PRC) will relend the funds from ADB with the same terms and conditions to the Gansu provincial government and the Baiyin municipal government. The loan rate will be 5-year US dollar fixed swap rate plus the ADB margin (of 0.5%) and a maturity premium of 0.2%, a total of 2.49% per annum.[6] The cost of equity is calculated at 8.0%, assuming a risk-free rate of return of 6.0% plus a 2.0% margin. The domestic loan rates from two domestic banks, the Industrial and Commercial bank of China (ICBC) at 7.2%, and the Bank of Gansu at 6.7%. Income tax is assumed at 17.0%, with the WACC calculated on an after-tax basis. The other assumptions are domestic inflation rate of 3% and international inflation rate of 1%. The computed real WACC for the component is 2.50% (Table 1).

Table 1: Calculation of the Weighted Average Cost of Capital

Source	Amount [a] ($ million)	Weighting (%)	Nominal Rate (%)	Tax (%)	Nominal Rate after Tax (%)	Inflation Rate (%)	Real Term (%)	WACC (%)
ADB loan	82.72	63	2.49	17.00	2.07	1.00	1.06	0.67
BMG equity	36.90	28	8.00	0.00	8.00	3.00	4.85	1.37
ICBC	11.47	9	7.20	17.00	5.98	3.00	2.89	0.25
Bank of Gansu	11.47	9	6.70	17.00	5.53	3.00	2.45	0.21
Total	131.09	100						
Real WACC								**2.50**

( ) = negative value, ADB= Asian Development Bank, BMG = Baiyin municipal government, ICBC = industrial and commercial bank of China, WACC = weighted average cost of capital

[a] The project cost includes expected future domestically funded projects for water distribution pipeline network expansion planned during the duration of the financial projection

Source: TA Consultants' estimates.

[4] In the LIP, the population is projected to grow from 12,797 in 2015 to 38,848 in 2020, and 77,897 in 2030 with domestic service connections of 4,266 in 2015, 12,949 in 2020 and 25,966 in 2030. Industrial connections are expected to increase from 8–10 in 2020 to about 35–40 in 2030. Demand follows projected short-term industrial development schedules of LIP during 2015–2017 for demand to serve existing industries and corresponding domestic worker household water requirements. Forecasts for 2020 and 2013 are based on the industrial demand assessment. The long-term demands accounted for daytime and nighttime worker population growth and incorporating worker-household members in LIP. Three population patterns have been investigated and the most conservative projection, based on actual land demand assessment, was used for the analysis.

[5] Since Jingyuan County is an agricultural county, water tariffs for domestic and industrial users are lower than that of Baiyin district. The projected tariff increases were considered feasible since the projected water and wastewater tariffs in 2019 are still lower than the levels of Baiyin district in 2013.

[6] As of 12 December 2012

d. Financial internal rate of return

5. The FIRR at 3.4% is higher than the WACC of 2.5%. The water supply and sanitation services in Liuchuan Industrial Park are therefore considered financially viable (Table 2). Sensitivity analysis shows that the FIRR is most sensitive to a 10% decrease in revenue, which will decrease the FIRR to 2.1%. The worst case scenario, a simultaneous 10% increase in capital and operating costs and a 10% decrease in revenue, which will decrease the FIRR to 0.8%.

Table 2: Financial Internal Rate of Return and Sensitivity Analysis

Sensitivity Analysis	**FIRR** (%)	**NPV** (CNY million)	**SI** (%)
Base Case	**3.4**	96	
(i) Capital costs: +10%	2.7	21	2.2
(ii) Operating costs: +10%	2.9	44	1.5
(iii) Reduction in revenue: –10%	2.1	-41	4.0
(iv) Combination of (i), (ii), and (iii)	0.8	-169	7.7
(v) 1-year delay in implementation	2.5	1	3.9
Weighted Average Cost of Capital	**2.5**		

( ) = negative value, CNY = Yuan, FIRR = financial internal rate of return, NPV = net present value, SI = sensitivity indicator.
Source: TA Consultants' estimates

e. Water and wastewater tariffs

6. The existing water tariff charged in Jingyuan County has been applied as these tariffs are acceptable to domestic and other users in Jingyuan County. The water tariffs are at CNY1.4 per m^3 for domestic customers and CNY2.2 per m^3 for industrials[7]. The wastewater tariffs are CNY0.7 per m^3 for domestic user and CNY1.0 for non-domestic users. The analysis concluded that initial adjustments are required to ensure capital and operational cost recovery. The analysis assumes a tariff increase of 10% every 3 years from 2017. The water and wastewater tariffs during the first year of operation in 2020 is CNY1.69 per m^3 for domestic customers, CNY2.66 per m^3 for industrial customers for water supply, and CNY0.85 per m^3 for domestic customers CNY1.21 per m^3 for industrial customers for sanitation. A lesson from past projects indicates that the water tariff should be carefully reviewed and simulated during project preparation. Given the fact that users of water and sanitation services are primarily industry and current level of tariffs in Jingyuan County are lower than those in Baiyin District, where industrial parks have been operated, this increase is considered feasible. In the event that revenues are not adequate to finance O&M and to repay the loan, the Jingyuan county government through the Liuchuan industrial park management committee will provide subsidies.

f. Affordability

7. The tariff analysis includes assessments of affordability for project beneficiaries and of the agreed degree of cost recovery during operation. The primary social objective of water and wastewater tariff structures should be to ensure that all members of the community have access to these services without placing an undue burden on their household expenditures. The average household incomes are based on socioeconomic survey and adjusted to current prices and GDP growth. Considering LIP and surrounding villages' average household size of 4.0 persons and daily water consumption of 90 liters per capita[8], and wastewater production at 80% of water consumption, the projected water and sewerage tariff increase would result in an estimated water and sanitation bill in 2020 of about CNY26.90 per month, equivalent to 0.4% of

[7] The tariff level is considered low in the PRC's average: CNY2.17 per m^3 for domestic customers and CNY3.23 per m^3 for nondomestic customers

[8] The figures are based on the field survey of surrounding villages and the residential complex of Rare Earth Company. In general, daily water consumption per capita of poor people is lower than the average.

the average household monthly income. The share of income expended is therefore considered affordable.

C. Financial Sustainability Analysis

8. The historical financial performance of project related entities was analyzed to determine their finance capacity to provide for cash requirements including equity contribution during construction, and O&M and debt service and loan repayment during the operation. In the project, BMG is assumed as the end borrower of ADB loan. The project counterpart fund will be transferred to the Jingyuan County Government and then to the Liuchuan industrial park management committee (LMC) on grant basis. For the domestic bank loans, the LMC will be a borrower of the loan and the JCG will guarantee it. BMG will provide the counterpart funding to ensure project completion, and thereafter pay debt service for ADB loan. For O&M, Baiyin municipal government, Jingyuan county government, and Baiyin public transportation company (BPT) will be identified entities for the ITS subproject (i.e. traffic security and control system), the road component under the Liuchuan industrial park infrastructure development subproject and TVET subproject, and the ITS subproject (i.e. public transportation management), respectively.

a. Approach

9. A review of the revenue and expenditure statements during the period 2009–2013 and financial projections until 2030 is undertaken for the entities to assess historical financial performance including capital structure, internal funds generation to support current operations, debt service capacity, and ability to finance O&M of the non-revenue generating components after construction.[9] The analysis calculated the historical compound average growth rate (CAGR) of revenues and expenditures noting the appropriate trends for a useful fiscal forecast. Fiscal revenues include tax (e.g. VAT, business tax, income tax, resource tax and real property tax), and non-tax revenues from ordinary resources, land transfer fees, reserve funds and upper-level government transfers for BMG and JCG. Fiscal expenditures for the governments include funds for general public services, education, science and technology, culture and sports, medical and sanitation, environmental protection, urban and rural community affairs, agriculture, forestry and water affairs, transportation, domestic and national security.

b. Counterpart Fund and Debt Service Coverage

10. As a percentage of annual revenues in 2015, the maximum annual capital expenditure, which comprised counterpart funds and interest during construction, is projected to be about 0.27% for Baiyin. Similarly, debt service during operation is projected to be less than 0.1% (Table 3). These findings indicate acceptable fiscal risk since fiscal revenues of the municipal government are expected to grow in line with economic development, providing more resource mobility for the municipal government to finance the project components and ensure loan repayment.

c. Operation and Maintenance Cost

11. Similarly, as a percentage of annual revenues during the initial period 2019-2020, the funds for O&M and debt service during operation is projected to be less than 0.1% of BMG for the ITS subproject (i.e. traffic security and control system), 2.4% of LMC for the road component

[9] Based on generally accepted criteria employed by the World Bank, the counterpart contributions are considered affordable to the municipality if the required annual amount does not exceed 15–20% of projected annual construction budget. As this is difficult to assess with available municipal construction budget data, the annual contribution is compared with overall annual municipal expenditure and also as a share of special infrastructure projects funded by the government. In the case of debt service, the acceptable standard is that debt service payments associated with the project should not exceed 2.5% of municipal revenues.

under the Liuchuan industrial park infrastructure development subproject, less than 0.01% of TVET subproject under the JCG, and 0.9% of BPT for the ITS subproject (i.e. public transportation management). The analysis concludes that, based on the identified funding sources during project preparation (including new budgets, subsidies, and allocated financing), all subprojects have sufficient funds available for O&M during operation (Table 3).

Table 3a: Baiyin Municipal Government Project Expenditure as Percentage of Revenue (CNY million)

Particulars	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Counterpart	63.61	91.99	142.15	117.49	39.62	-	-	-	-	-	-	-	-	-
% Expenditures	0.30%	0.34%	0.44%	0.30%	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Revenues	0.27%	0.32%	0.41%	0.28%	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O&M Cost	-	-	1.45	1.49	1.54	1.58	1.63	1.68	1.73	1.78	1.83	2.13	2.46	2.86
% Revenues	0.000%	0.000%	0.004%	0.004%	0.003%	0.003%	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.000%	0.000%
Debt Service	-	-	-	-	-	38.94	38.94	38.94	38.94	38.94	38.94	38.94	38.94	-
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	0.05%	0.05%	0.04%	0.03%	0.03%	0.01%	0.01%	0.00%
Total Requirement	63.61	91.99	143.59	118.99	41.16	40.53	40.57	40.62	40.67	40.72	40.78	41.07	41.41	2.86
% Revenues	0.27%	0.32%	0.41%	0.29%	0.08%	0.07%	0.06%	0.05%	0.04%	0.03%	0.03%	0.01%	0.01%	0.00%

Table 3b: Jingyuan County Government Project Expenditure as Percentage of Revenue (CNY million)

Particulars	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Counterpart	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Expenditures	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O&M Cost	-	-	0.39	0.40	0.42	0.43	0.44	0.45	0.47	0.48	0.50	0.58	0.67	0.77
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Debt Service	84.40	79.36	24.32	22.88	21.44	-	-	-	-	-	-	-	-	-
% Revenues	1.45%	1.01%	0.25%	0.19%	0.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Requirement	84.40	79.36	24.71	23.28	21.86	0.43	0.44	0.45	0.47	0.48	0.50	0.58	0.67	0.77
% Revenues	1.45%	1.01%	0.25%	0.19%	0.14%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 3c: Bureau of Public Transport Project Expenditure as Percentage of Revenue (CNY million)

Particulars	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Counterpart	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00
% Expenditures	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%
O&M Cost	-	-	0.71	0.74	0.76	0.78	0.80	0.83	0.85	0.88	0.91	1.05	1.22	1.41
% Revenues	0.00%	0.00%	1.06%	1.00%	0.94%	0.88%	0.82%	0.77%	0.73%	0.68%	0.64%	0.47%	0.34%	0.25%
Debt Service	-	-	-	-	-	-	-	-	-	-	-	-	-	1.00
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%
Total Requirement	-	-	0.71	0.74	0.76	0.78	0.80	0.83	0.85	0.88	0.91	1.05	1.22	1.41
% Revenues	0.00%	0.00%	1.06%	1.00%	0.94%	0.88%	0.82%	0.77%	0.73%	0.68%	0.64%	0.47%	0.34%	0.25%

Table 3d: Liuchuan Industrial Park Project Expenditure as Percentage of Revenue (CNY million)

Particulars	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Counterpart	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Expenditures	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O&M Cost	-	-	-	-	-	6.97	7.18	7.39	7.61	7.84	8.08	9.36	10.86	12.58
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	2.39%	2.14%	1.91%	1.71%	1.58%	1.45%	0.95%	0.63%	0.41%
Debt Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total Requirement	-	-	-	-	-	6.97	7.18	7.39	7.61	7.84	8.08	9.36	10.86	12.58
% Revenues	0.00%	0.00%	0.00%	0.00%	0.00%	2.39%	2.14%	1.91%	1.71%	1.58%	1.45%	0.95%	0.63%	0.41%

LINKED DOCUMENT 6
ECONOMIC ANALYSIS

A. Introduction

1. The economic analysis is undertaken for the components and subcomponents including roads, water supply and wastewater in the Liuchuan Industrial Park (LIP) in Jingyuan County, and intelligent transport system (ITS), public transport improvement and technical and vocational education and training (TVET) in Baiyin District. The economic analysis follows ADB *Guidelines for the Economic Analysis of Projects*, which requires least-cost analysis (LCA) of available project options that consider technical factors, including demand, materials supply, and costs. The LCA ensures each subcomponent / component is optimally designed to meet its goals without unnecessary costs. Based on the Guidelines, each individual subcomponent / component must be economically justified through application of benefit-cost analysis. Thus, the economic rates of return (EIRR) for the four subcomponents / components were derived. As the main economic viability measure in the analysis, the EIRR of each must exceed the economic opportunity cost of capital (EOCC) at 12% to be considered economically viable. The analysis uses the annual discounted cash flow model where benefit streams are matched against cost streams. The model also calculates the economic net present value (ENPV) and provides a summary of the risk and sensitivity analysis. The analysis investigates component / subcomponent risks through probable economic scenarios that include capital and operating cost overruns, reduced benefits over time, and project implementation delay. For wastewater, cost-effectiveness analysis was prepared to avoid double counting of the benefits forecasted to be obtained from water supply development.

B. Least Cost Analysis

2. Each subcomponent included in the list is designed to meet the goals of the project at least cost. The LCA includes all feasible options for a given subcomponent, and considered variations in location, planning horizon, demand and design. A minimum of two alternatives have been assessed for each subcomponent based on the technical options. LCA ensures each subcomponent is optimally designed to meet its goals without unnecessary costs.

3. Because of the limited measurable subcomponent outputs for the project, the lowest present value of economic cost (PVEC) approach is adopted in determining the least cost alternative among the technical options. The present value of incremental investment and O&M costs are calculated using the economic discount rate at 12%, and the option with the lowest PVEC is the least cost alternative. Cost analyses are derived from a comparison of “with” and “without project” components. **Table 1** summarizes the options and the results of LCA using PVEC. The least cost option is also the design institute’s (DI) recommended option.

Table 1: Results of Least Cost Analysis Options for All Components

Subcomponent	Item	Option	Least cost option	Recommended by the DI
Wastewater treatment	Sewage pipeline	Option 1: RCP	√	√
		Option 2: HDPE		
		Option 3: GRP		
	Wastewater treatment processes	Option 1: G-BAF process	√	√
		Option 2: CASS process		
		Option 3: Improved A/A/O process		
Water supply	Pump series	Option 1: Single-stage	√	√
		Option 2: Double-stage		
	Water distribution pipeline	Option 1: DIP	√	√
		Option 2: PVC-M		
Road	Road pavement	Option 1: Asphalt	√	√
		Option 2: Cement		

C. Economic Evaluation

4. Economic viability is measured in terms of EIRR, which should be greater than the opportunity cost of capital. A critical sensitivity analysis will complete the cost-benefit analyses (CBA) considering the impacts of alternative assumptions, risks and imponderables. The CBA follows standard ADB guidelines on economic analysis of subprojects.

C.1 Assumptions

5. Costs and benefits are in March 2014 prices. Financial costs of foreign components are adjusted to their economic values using shadow exchange rate factor (SERF) at 1.01. The shadow wage rate factor (SWRF) for unskilled labor is assumed at 0.67. Unskilled labor comprises 30% of labor cost. Conversion factor for skilled labor and non-traded is at 1.0. Taxes and duties are excluded. CBA uses the discounted cash flow method where cost and revenue streams are compared and discounted using the EOCC. EOCC applies ADB standard at 12%. The cash flows are in real prices and inflationary effects are excluded. CBA covers a 25-year period starting at 2015.

C.2 Economic Costs

6. To reflect costs from the standpoint of the economy, taxes and duties, price inflation and market distortions, where any, are excluded from the financial costs and these are converted into economic costs using a domestic price numéraire. Both the project capital cost and the operation and maintenance (O&M) cost are distributed into traded and non-traded components and labor. Annual economic capital cost distribution follows the annual financial investment plan and cost disbursement schedule based on the financial analysis with results given in **Linked Document 5**.

7. **TVET.** The TVET program will finance rehabilitation of training facility, training and testing equipment, information and communication technology equipment and software, educational materials printing, and workshops. TVET is 100% foreign currency component. After all transfer costs are deducted, the financial cost is adjusted to arrive at the economic project cost at CNY18.07 million as shown in **Table 2**.

Table 2: Economic Cost Conversion – TVET Component

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Rate
Civil Works	CNY million	-	-	-
Materials & Equipment	CNY million	16.22	16.43	1.01
Engineering	CNY million	-	-	-
Consultants	CNY million	-	-	-
Land, Resettlement	CNY million	-	-	-
Base Cost	CNY million	16.22	16.43	1.01
Physical Contingency	CNY million	1.62	1.64	1.01
Total Cost	CNY million	17.84	18.07	1.01

8. Expenditure budget is provided to support recurrent cash requirements of the program during the operational stage. The O&M cost comprises program staff costs at 7% of the capital cost; direct operating costs including administrative, utilities and maintenance costs at 2%; and miscellaneous expenditures including budget support for out-of-pocket expense allowance for on-grant students at 3.7%. Annual O&M cost is estimated at CNY2.30 million in real prices. Annual economic O&M costs and economic capital cost details are given in **Appendix Tables A-1** and **A-2,** respectively.

9. **ITS and Public Transport System.** The ITS component will finance the short-term plan for traffic management system development in Baiyin District. The short-term program will finance the traffic police ITS including improvements to the operation center, signal controls, electronic police, video monitoring and violation recording and traffic guidance. The program will also fund the public transport ITS, which includes on-board equipment, bus stop and depot equipment, operation center and software and system installation service. The un-inflated financial cost amounts to CNY39.65 million, of which 97% is foreign currency cost. **Table 3** shows the economic cost at CNY39.92 million.

Table 3: Economic Cost Conversion – ITS AND PT Component

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Rate
Civil Works	CNY million	-	-	-
Materials & Equipment	CNY million	33.78	34.53	1.02
Engineering	CNY million	2.26	1.77	0.78
Consultants	CNY million	-	-	-
Land, Resettlement	CNY million	-	-	-
Base Cost	CNY million	36.04	36.29	1.01
Physical Contingency	CNY million	3.60	3.63	1.01
Total Cost	CNY million	39.65	39.92	1.01

10. O&M costs for traffic police ITS are estimated at 5% of the capital cost and public transport program at 6%. The annual O&M cost is projected at CNY4.3 million in real prices. **Appendix Tables B-1** and **B-2** present details of the economic capital and O&M costs, respectively.

11. **Road.** The road subcomponent includes costs for works and materials for the construction of 6.022 km of road, including pavement, sub-grade, bridge, box culvert, drainage, sewage, lighting, water supply, greening and traffic works. The un-inflated financial cost is CNY297.42 million, with economic capital cost at CNY237.90 million after conversion. The foreign currency component is at 8% of financial cost. **Table 4** presents the cost conversion.

Table 4: Economic Cost Conversion – Road subcomponent

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Factor
Civil Works	CNY million	195.91	157.41	0.80
Materials & Equipment	CNY million	-	-	-
Engineering	CNY million	11.77	9.21	0.78
Consultants	CNY million	2.70	2.74	1.01
Land, Resettlement	CNY million	60.00	46.92	0.78
Base Cost	CNY million	270.39	216.28	0.80
Physical Contingency	CNY million	27.04	21.63	0.80
Total Cost	CNY million	297.42	237.90	0.80

12. The road subcomponent recurrent cost requirement includes staff, electricity and road routine repair costs at 1% of the capital cost, and bridge maintenance expense at 0.5%.

13. **Water Supply.** The water supply subcomponent will finance source development designed to provide 60,000 m^3/d, 14.3 km of transmission pipeline, and 13.9 km of distribution pipeline. The financial capital cost is estimated at CNY499.51 million excluding price contingency. The foreign currency portion accounts for 15% of the total. The economic capital cost amounts to CNY407.60 million as shown in **Table 5.**

Table 5: Economic Cost Conversion – Water supply subcomponent

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Rate
Civil Works	CNY million	339.36	272.67	0.80
Materials & Equipment	CNY million	65.07	58.40	0.90
Engineering	CNY million	21.47	16.79	0.78
Consultants	CNY million	2.70	2.74	1.01
Land, Resettlement	CNY million	25.50	19.94	0.78
Base Cost	CNY million	454.10	370.54	0.82
Physical Contingency	CNY million	45.41	37.05	0.82
Total Cost	CNY million	499.51	407.60	0.82

14. O&M costs for water supply include personnel salaries, chemical treatment, power and fuel, maintenance and miscellaneous materials. Details of economic capital and O&M costs are given in **Appendix Table D-1 and D-2**.

15. **Wastewater.** The subcomponent will finance wastewater treatment plant designed to treat 35,000 m^3/d, and pipeline network of 46.035 km. The financial capital cost, excluding price inflation, is estimated at CNY269.72 million, with 20% in foreign cost. The economic capital cost after conversion is at CNY222.35 million as given in **Table 6**.

Table 6: Economic Cost Conversion – Wastewater supply subcomponent

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Rate
Civil Works	CNY million	166.35	132.60	0.80
Materials & Equipment	CNY million	62.68	56.26	0.90
Engineering	CNY million	12.47	9.75	0.78
Consultants	CNY million	2.70	2.74	1.01
Land, Resettlement	CNY million	1.00	0.78	0.78
Base Cost	CNY million	245.20	202.14	0.82
Physical Contingency	CNY million	24.52	20.21	0.82
Total Cost	CNY million	269.72	222.35	0.82

16. O&M costs for wastewater include personnel salaries, chemical treatment, power and fuel, maintenance and miscellaneous materials. Details of economic capital and O&M costs are given in **Appendix Table E-1 and E-2.**

C.3 Economic Benefits

C.3.1 TVET

17. The benefits for the TVET component draw from potentially higher wages for graduates of the technological and vocational schools and institutes in Baiyin. With higher wages come the opportunities to contribute to the cash economy and to revenue generation efforts of localities. TVET aims to support vocational and technical skills of graduates in meeting the labor needs of LIP's new and emerging industries. TVET will also improve access of agricultural workers, unemployed labor force and surplus labor to new and enhanced skills that increase employment opportunities. Graduation rates in Gansu for secondary vocational students averaged 86%, while for higher vocational training the rate averaged 78%. The graduates are expected to maintain a high or better hiring rate because of the project, no less than the prevailing graduate hiring rates in Gansu and Baiyin Municipality at 95%. **Table 7** shows the current trends in vocational and technological education in Gansu Province.

Table 7: TVET Admission, Graduation and Hiring Rates in Gansu Province

Item	Unit	2011	2012	Average
Vocational Secondary (1-3-year course)				
Admissions	Number	119,100	117,721	118,411
Graduation Rate	Rate	86%	86%	86%
Graduates	Number	102,700	101,413	102,057
Hiring Rate	Rate	95%	95%	95%
Graduates Hired	Number	97,565	96,342	96,954
Vocational Higher (4-year course)				
Admissions	Number	55,478	58,515	56,997
Graduation Rate	Rate	78%	78%	78%
Graduates	Number	43,427	45,652	44,540
Hiring Rate	Rate	95%	95%	95%
Graduates Hired	Number	41,256	43,369	42,313
Total Vocational				
Admissions	Number	174,578	176,236	175,407
Graduates	Number	146,127	147,065	146,596
Graduates Hired	Number	138,821	139,712	139,266
Vocational Secondary/Total Vocational	Rate	68%	67%	68%
Vocational Higher/Total Vocational	Rate	32%	33%	32%

18. In the analysis, about 1,200 enrollees will graduate every 5-year period. Annual enrollment is estimated at 240 students. The designated TVET schools have a potential to admit more at 6,000 with improved facilities. The annual graduates will find easy accommodation in LIP's jobs, which number about 40,000 by 2020, rising to over 70,000 by 2030. It is expected that there will be no shortage of students, even from Jingyuan County and Baiyin District alone where surplus labor force participants from the agricultural sector is estimated to average 2,000 annually. The capacity-building component to develop labor market information and employment services in Jingyuan will also reinforce project resolution to prevent gaps.

19. With the project, salaries of graduates employed in LIP's jobs and elsewhere where they will be needed will be higher than the minimum wage by about 10%. At the least TVET contributes to "increase in industrial productivity", which is based on 7.5% per annum PRC's GDP growth in next 5 years, gradually slowing down and settling at 5% in the following years. In 2013, the average income of graduates of standard skills training at technical and vocational schools is reported at a conservative CNY2,000 in Gansu, slightly higher than minimum. Graduates of higher TVET receive a premium at a conservative 10% over standard rates.

20. The total number of years that student graduates of the TVET component are assumed to work as full-time workers in their related programs, assumed at least five years in the analysis, gives a measure of the quantifiable incremental benefits earned by each graduate.

C.3.2 ITS and Public Transport

21. **ITS installation**. The benefits for the ITS component derives from incidents avoided with the installation of technologically advanced equipment at the identified areas, the traffic operations center and the traffic management bureau. The component is expected to influence the coverage area by reducing the number of incidents by at least 10%. Incident benefits are valued depending on the severity of the accidents and the damage to life and property. Incidents are generally classified as fatal or non-fatal. Benefits from avoided incidents are estimated using two methods: (i) by the willingness to pay for improvements that will reduce incidence, and (ii) by the human capital valuation. The analysis applied the latter method. The Traffic Police Detachment has provided information on actual incidents in Baiyin District, as shown in **Table 8.**

Table 8: Baiyin District Traffic Incidents, 2012-2013

Traffic Incidents	Unit	2012	2013	Average
Major Accident	Number	25	23	23
Loss – fatality	Number	10	10	10
Loss – injury permanent	Number	32	33	28
Slight Accident	Number	1,114	1,260	1,153
Loss – injury non-permanent	Number	87	262	154
Total Incidents	Number	1,139	1,283	1,176
Property Damage Only	Number	1,010	978	984
Loss – direct property damage	CNY	479,660	449,425	374,359
Average Cost Property Damage Only	CNY	475	460	380

22. For fatal accidents, benefits are valued from labor output lost. Potentially productive years of life lost because of a fatal accident are considered. The average retirement age presently in PRC is at 60 years. With the average age of fatalities at the time of accident assumed at 40 years, what would have otherwise been potentially productive would be 20 years. Lost labor output is calculated by multiplying the potentially productive years lost by the average annual income based on the average annual income in Baiyin Municipality at CNY45,062 in 2012, adjusted to the current using the gross domestic product (GDP) growth rate. The GDP rate is also used to forecast real wage increases. The average number of passengers in Baiyin District is assumed at two per vehicle, with 30% assumed for number of wage earners. The number of fatalities is reported at 10 per year in 2012 and in 2013, equivalent to 0.14 per million-passenger volume annually.

23. For non-fatal accidents, benefits from component implementation are measured from avoided medical costs including hospitalization, labor output lost due to temporary disability during recuperation period and labor output lost due to permanent disability. Non-fatal casualties sustaining temporary disability are calculated at 154 per million-passenger volume annually, while those suffering from permanent disability number about 28. Temporarily disabled casualties spend for medical cost averaging CNY183 (about $25) per day for an estimated period of 7 days. The number of wage-earners among casualties is assumed at 30% and lost labor output at CNY84 per day (based on an average annual wage in Baiyin Municipality in 2012 at CNY45,062, adjusted to the current using GDP growth rate) for 7 days out of work. For non-fatal casualties who become permanently disabled, the number of potentially lost productive years is as assumed for fatalities at 20 years, based on a retirement age at 60 years and average age at the time of incident at 40 years.

24. Property damage comprises the largest number of incidents in Baiyin District, numbering about 1,000 cases annually from 2012 to 2013. The average cost to property alone (vehicles, garages, road implements etc.) is estimated at CNY380 (in 2014) per incident. Benefits arising from reduced accidents resulting in property damage are valued by multiplying the number of incidents by the average cost of property damaged.

25. **Public transport (bus) system improvement**. For the improvements in public transport system with the project, the main benefit is savings on passenger waiting time at bus stations. In 2012, bus ridership in Baiyin District is reported at 130,000 daily transported by some 200 buses that accommodate an average of 40-50 passengers. Waiting time by passengers at bus stops averages 12 minutes. The installation of ITS will shorten waiting time by at least 9% by providing real-time traffic information that will improve public transport dispatch at terminals, while providing the same information on-board the vehicles to guide drivers through less congested routes. Information boards will be installed at waiting stops thus also aiding passengers to plan their trips. Time saved is approximated in terms of leisure time of passengers reduced due to waiting time, and using average wages to measure the equivalent value to the riders. Leisure time is assumed about 10-20% of workers' time.

26. Other benefits not quantified include travel time and vehicle operating cost (VOC) savings, and lower carbon emissions from less fuel consumption by public vehicles. As

suggested, ITS in transport systems will decrease congestion and improve traffic flow and affect the environment considerably. Vehicle speed increases while delay time at critical intersections decreases. Quicker response by police and emergency units to incidents protects and saves lives. For society as a whole, pain and grief at loss and debilitation is ameliorated.

C.3.3 Road

27. The main benefit for the road subcomponent is time savings due to shorter travel route with the construction of the proposed 6-kilometer road section along Xihuan Road. With the project in place, it is estimated the daily road users traversing interconnecting routes to this road will, on average, travel 5 kilometers less. The economic value of time savings can be derived from three approaches: (i) stated preference survey, (ii) empirical relationship between savings in passenger travel time and per capita GDP through regression, or (iii) appropriate income levels. The third approach is applied in the analysis where economic benefit is estimated by calculating the time difference traversing this shortened distance and valuing the time saved based on road users' average wages.

28. Planned LIP's road construction is partially completed with the remaining works either ongoing or still to be implemented. When completed, in addition to internal vehicular traffic, LIP's roads will serve external trip destinations in three regions: Baiyin, Jingyuan and Pingchuan. The Xihuan Road subcomponent is located at the southwestern reaches of the LIP, and will provide quickest access to business travelers to the LIP from the external regions, particularly from Baiyin, and vice-versa. **Supplementary Document 3 C** – Technical Analysis of the Road Subcomponent, diagrams the major traffic zones (TZ) in 2030 in **Figure 8,** and the desire line of the projected daily trips by TZ in **Figure 11.** Baiyin is designated TZ 2, Jingyuan, TZ 9, and Pingchuan, TZ 13. The number of road users is derived using available origin-destination (O-D) data in each TZ from the FSR. To be conservative, only vehicle trip generation and attraction from TZ 2 and its linkages are used in the analysis. The estimated distances travelled and vehicle counts that access TZ 2 are given in **Table 9.**

Table 9: Distances Travelled by Vehicles at O-D Points, 2015

Traffic Zones	Distance Traveled			Vehicle Count	
	Without Project km	With Project km	Variance km	1-way number	2-way number
O-D Points TZ 2 to TZ 6	11.7	4.0	7.7	94	188
O-D Points TZ 2 to TZ 7	11.3	2.9	8.4	62	124
O-D Points TZ 2 to TZ 8	8.5	2.1	6.4	63	126
O-D Points TZ 2 to TZ 9	11.6	4.8	6.8	53	106
O-D Points TZ 2 to TZ 10	6.8	3.2	3.5	42	84
O-D Points TZ 2 to TZ 11	9.7	4.0	5.6	78	156
O-D Points TZ 2 to TZ 12	8.7	4.0	4.7	75	150
O-D Points TZ 2 to TZ 13	5.1	4.5	0.6	71	142
O-D Points TZ 2 to TZ 14	9.7	8.0	1.6	101	202
Total Distance O-D Points TZ 2 –	83.0	37.7	45.4	639	1,278

29. The economic value of reduced travel time for a business trip is assumed associated with personal income in the project area for travelers using cars, transport vans and light buses, goods transporters and other light vehicles. The average number of passengers per car is assumed at three persons, of which 50% are traveling during work hours. Average income per capita in the LIP is based on 2012 average annual income in various sectors in Baiyin Municipality estimated at CNY45,062. Adjusted to annual growth rate, this is equivalent to CNY58,000 in 2017. The estimated value of time savings per passenger-hour is shown in **Table 10.**

Table 10: Economic Value of Savings in Travel Time

Annual income in 2017 CNY	Passengers traveling in work time	Vale of time savings per passenger-hour CNY	Average passengers per vehicle	Value of Passenger time per hour CNY
58,000	50%	22.50	3.0	62.50

30. Other benefits are expected to arise from project implementation including VOC savings, freight cost savings from longer delivery periods and goods spoilage, and lower carbon emissions from fuel used in saved travel distances. However, these have not been quantified in the analysis.

C.3.4 Water Supply and Sanitation

31. For water supply, the benefits include beneficiary willingness-to-pay for improved and expanded (incremental) water service, improved health, and user resource savings. The willingness-to-pay price has been derived from the social survey that covered domestic and non-domestic users. Domestic tariffs are subjected to user affordability analysis to ensure tariff acceptability and subcomponent sustainability.

32. The water supply facilities of the project will reduce the total economic cost of obtaining water for each household and enterprise. Water supplied by the project will replace water used by Gansu Rare Earth Company (GREC) and the existing households (non-incremental demand), and will enable LIP's enterprises and households to increase their consumption (incremental demand). The project is projected to replace most of the private water supplies currently used by the enterprise and households.

33. Resource cost savings are estimated by multiplying the quantity of water consumed without the project, i.e. non-incremental quantity, by the average economic supply price in the without project situation. Considering new water supply plants will replace the old water supply facility that services GREC and households nearby, the savings estimate is based on the water consumption of the enterprise and the households with the economic price.

34. The value of incremental water is based on the average willingness-to-pay as a proxy for the demand price of water of the project. The demand price of water without the project is the financial demand price of the various alternative sources. The average demand price of water with the project is based on the average willingness-to-pay as proxy for the demand price of water, which averages CNY2.52 per m^3 for domestic consumption and CNY4.10 per m^3 for commercial and industrial usage. The total value of non-incremental and incremental water makes up the gross total economic benefits of the water supply subcomponent.

35. Benefits accruing directly to wastewater service are difficult to quantify especially as they are knitted to water supply. Information on willingness-to-pay of future LIP households drawn from the social survey does not specifically segregate wastewater from water. It is difficult to predict domestic composition and economic conditions with the available results. The impacts that are associated with improvements in wastewater collection and treatment include (i) lower discharge of untreated wastewater to receiving streams, and (ii) reduced frequency of surface water contamination due to combined sewer overflows. Benefits derived from these impacts include (i) reduced risk of human exposure to waterborne pathogens in surface waters, and (ii) public health and environmental benefits.

D. Results of Economic Evaluation

36. **Economic internal rate of return.** The EIRR is derived for the individual components / subcomponents and consolidated for the project as a whole. The EIRR for the component / subcomponents range between 15.7% and 23.7%. The EIRR for the project as a whole is **16.3%**. For the LIP component, the overall EIRR is 14.5%. The proposed investments are

therefore economically justified individually and when consolidated as a whole with the EIRR higher than the economic opportunity cost of capital (EOCC) at 12%.

37. **Sensitivity and risk analysis.** Sensitivity analysis is carried out for the individual components / subcomponents and for the project as a whole. Sensitivity scenarios investigated include (i) 10-20% increase in capital investment, (ii) 10-20% increase in O&M cost, (iii) 10-20% increase in combined capital and O&M costs, (iv) 10-20% reduction in benefits, (v) combined (iii) and (iv), and (vi) delay in project or component / subcomponent implementation by one year. The sensitivity analysis shows the individual components / subcomponents and the consolidated project remaining robust in all but three cases: in the road subcomponent, under a combined benefit reduction and increase in total costs; in the ITS and water supply subcomponents, under the same case. Overall, the project is likewise most sensitive to the combined reduced benefit and increased costs. The results of the individual EIRR and sensitivity analyses are given in **Appendix Tables A-3, B-3, C-3 and D-3** for TVET, ITS, road and water supply and sanitation, respectively. The consolidated analyses are presented in **Appendix Table E-1.**

APPENDIX A: ECONOMIC ANALYSIS OF TVET COMPONENT

Table A-1: Economic Investment Cost (in CNY Million)

Components	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 30%	Balance Local Cost	Taxes 17%	Other Costs	Foreign x SERF 1.01	Unskilled x SWRF 0.67	Other Cost x 1.00	Economic Project Cost
Civil Works	-	-	-	-	-	-	-	-	-	-	-
Materials & Equipment	16.22	16.22	-	-	-	-	-	16.43	-	-	16.43
Engineering	-	-	-	-	-	-	-	-	-	-	-
Consultants			-	-	-	-	-	-	-	-	-
Land, Resettlement	-	-	-	-	-	-	-	-	-	-	-
Base Cost	16.22	16.22	-	-	-	-	-	16.43	-	-	16.43
Physical Contingency	1.62	1.62	-	-	-	-	-	1.64	-	-	1.64
Total Cost	17.84	17.84	-	-	-	-	-	18.07	-	-	18.07

Table A-2: Economic O&M Cost (in CNY Million)

Components	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Staff Costs		0.32	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
O&M Cost	0.09	0.18	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Other O&M Cost	0.17	0.33	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Total O&M cost	0.26	0.83	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30

Table A-3: EIRR and Sensitivity Analysis

Year	Benefits	Costs			Net Inflow (Outflow)						
	Benefit	Total	Capital	O&M	Base Case	Cap Cost + 20%	O&M Cost + 20%	Total Cost + 20%	Benefit - 20%	Benefits - Total Cost + 20%	Delay by 1-year
2015	-	3.61	3.61	-	- 3.61	- 4.34	- 3.61	- 4.34	- 3.61	- 4.34	- 3.61
2016	-	3.61	3.61	-	- 3.61	- 4.34	- 3.61	- 4.34	- 3.61	- 4.34	- 3.61
2017	-	3.87	3.61	0.26	- 3.87	- 4.60	- 3.92	- 4.65	- 3.87	- 4.65	- 3.87
2018	-	4.45	3.61	0.83	- 4.45	- 5.17	- 4.61	- 5.34	- 4.45	- 5.34	- 4.45
2019	-	5.91	3.61	2.30	- 5.91	- 6.63	- 6.37	- 7.09	- 5.91	- 7.09	- 5.91
2020	-	2.30	-	2.30	- 2.30	- 2.30	- 2.75	- 2.75	- 2.30	- 2.75	- 2.30
2021	0.49	2.30	-	2.30	- 1.81	- 1.81	- 2.26	- 2.26	- 1.90	- 2.36	- 2.30
2022	1.52	2.30	-	2.30	- 0.78	- 0.78	- 1.24	- 1.24	- 1.08	- 1.54	- 1.81
2023	3.68	2.30	-	2.30	1.38	1.38	0.92	0.92	0.65	0.19	- 0.78
2024	6.51	2.30	-	2.30	4.22	4.22	3.76	3.76	2.91	2.46	1.38
2025	10.98	2.30	-	2.30	8.68	8.68	8.22	8.22	6.49	6.03	4.22
2026	17.23	2.30	-	2.30	14.93	14.93	14.47	14.47	11.49	11.03	8.68
2027	23.30	2.30	-	2.30	21.00	21.00	20.54	20.54	16.34	15.88	14.93
2028	29.16	2.30	-	2.30	26.87	26.87	26.41	26.41	21.03	20.57	21.00
2029	34.24	2.30	-	2.30	31.94	31.94	31.48	31.48	25.09	24.63	26.87
2030	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	31.94
2031	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2032	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2033	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2034	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2035	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2036	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2037	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2038	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2039	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
2040	39.00	2.30	-	2.30	36.70	36.70	36.24	36.24	28.90	28.44	36.70
EIRR					23.7%	22.3%	23.0%	21.6%	21.2%	19.1%	21.4%
ENPV	71.70	24.89	13.03	11.86	46.81	44.20	44.44	41.83	32.47	27.49	37.30
Sensitivity Indicator											
EIRR						0.62	0.31	0.89	1.09	1.96	0.31
ENPV						0.28	0.25	0.53	1.53	2.06	0.31
Switching Value											
EIRR						1.62	3.26	1.12	0.92	0.51	3.24
ENPV						3.59	3.95	1.88	0.65	0.48	3.21

APPENDIX B: ECONOMIC ANALYSIS OF ITS COMPONENT

Table B-1: Economic Investment Cost

Components	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 30%	Balance Local Cost	Taxes 17%	Other Costs	Foreign x SERF 1.01	Unskilled x SWRF 0.67	Other Cost x 1.00	Economic Project Cost
Civil Works	-	-	-	-	-	-	-	-	-	-	-
Materials & Equipment	33.78	35.10	-1.31	-0.39	-0.92	-0.16	-0.76	35.56	-0.26	-0.76	34.53
Engineering	2.26	-	2.26	0.68	1.58	0.27	1.31	-	0.45	1.31	1.77
Consultants			-	-	-	-	-	-	-	-	-
Land, Resettlement	-	-	-	-	-	-	-	-	-	-	-
Base Cost	36.04	35.10	0.94	0.28	0.66	0.11	0.55	35.56	0.19	0.55	36.29
Physical Contingency	3.60	3.51	0.09	0.03	0.07	0.01	0.05	3.56	0.02	0.05	3.63
Total Cost	39.65	38.61	1.04	0.31	0.73	0.12	0.60	39.11	0.21	0.60	39.92

ITS = Intelligent transport system, PT = Public transport

Table B-2: Economic O&M Cost

Component	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Traffic Police ITS	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81
Public Transport ITS	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49	2.49
Other O&M	-	-	-	-	-	-	-	-	-	-	-	-
Total O&M cost	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30

Table B-3: EIRR and Sensitivity Analysis

Year	Benefits				Costs			Net Inflow (Outflow)						
	Total	ITS Labor Output Lost	ITS Property Damage	PT Time Savings	Total	Capital	O&M	Base Case	Cap Cost + 20%	O&M Cost + 20%	Total Cost + 20%	Benefit - 20%	Benefits - Total Cost + 20%	Delay by 1-year
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	19.96	19.96	-	- 19.96	- 23.95	- 19.96	- 23.95	- 19.96	- 23.95	- 19.96
2017	1.11	0.47	0.02	0.62	24.26	19.96	4.30	- 23.15	- 27.14	- 24.01	- 28.00	- 23.37	- 28.23	- 24.26
2018	3.75	0.96	0.03	2.76	4.30	-	4.30	- 0.55	- 0.55	- 1.40	- 1.40	- 1.30	- 2.16	- 3.19
2019	5.63	0.98	0.03	4.62	4.30	-	4.30	1.33	1.33	0.47	0.47	0.21	- 0.65	- 0.55
2020	8.17	1.24	0.03	6.89	4.30	-	4.30	3.87	3.87	3.01	3.01	2.23	1.37	1.33
2021	9.19	1.29	0.03	7.86	4.30	-	4.30	4.89	4.89	4.03	4.03	3.05	2.19	3.87
2022	10.20	1.33	0.03	8.85	4.30	-	4.30	5.90	5.90	5.04	5.04	3.86	3.00	4.89
2023	11.32	1.36	0.03	9.93	4.30	-	4.30	7.02	7.02	6.16	6.16	4.76	3.90	5.90
2024	12.55	1.39	0.03	11.13	4.30	-	4.30	8.25	8.25	7.39	7.39	5.74	4.88	7.02
2025	13.90	1.42	0.03	12.45	4.30	-	4.30	9.60	9.60	8.74	8.74	6.82	5.96	8.25
2026	15.38	1.45	0.03	13.90	4.30	-	4.30	11.08	11.08	10.22	10.22	8.00	7.14	9.60
2027	17.07	1.54	0.03	15.50	4.30	-	4.30	12.77	12.77	11.91	11.91	9.36	8.50	11.08
2028	18.93	1.64	0.03	17.27	4.30	-	4.30	14.63	14.63	13.77	13.77	10.84	9.98	12.77
2029	20.97	1.74	0.03	19.20	4.30	-	4.30	16.67	16.67	15.81	15.81	12.47	11.62	14.63
2030	23.27	1.85	0.03	21.40	4.30	-	4.30	18.98	18.98	18.12	18.12	14.32	13.46	16.67
2031	24.44	1.94	0.03	22.47	4.30	-	4.30	20.14	20.14	19.28	19.28	15.25	14.39	18.98
2032	25.66	2.04	0.03	23.59	4.30	-	4.30	21.36	21.36	20.50	20.50	16.23	15.37	20.14
2033	26.94	2.14	0.03	24.77	4.30	-	4.30	22.64	22.64	21.78	21.78	17.25	16.39	21.36
2034	28.28	2.25	0.03	26.01	4.30	-	4.30	23.98	23.98	23.12	23.12	18.33	17.47	22.64
2035	29.70	2.36	0.03	27.31	4.30	-	4.30	25.40	25.40	24.54	24.54	19.46	18.60	23.98
2036	31.18	2.48	0.03	28.67	4.30	-	4.30	26.88	26.88	26.02	26.02	20.64	19.78	25.40
2037	32.74	2.60	0.03	30.11	4.30	-	4.30	28.44	28.44	27.58	27.58	21.89	21.03	26.88
2038	34.37	2.73	0.03	31.61	4.30	-	4.30	30.07	30.07	29.21	29.21	23.20	22.34	28.44
2039	36.09	2.87	0.03	33.19	4.30	-	4.30	31.79	31.79	30.93	30.93	24.57	23.71	30.07
2040	37.89	3.01	0.03	34.85	4.30	-	4.30	33.59	33.59	32.73	32.73	26.01	25.15	31.79
EIRR								16.5%	14.9%	15.3%	13.8%	13.2%	10.7%	14.2%
ENPV	77.33	8.43	0.17	68.73	56.80	30.12	26.68	20.53	14.51	15.20	9.17	5.07	- 6.29	10.47
Sensitivity Indicator														
EIRR									1.82	1.37	3.02	3.67	6.48	1.92
ENPV									1.47	1.30	2.77	3.77	6.53	1.85
Switching Value														
EIRR									0.55	0.73	0.33	0.27	0.15	0.52
ENPV									0.68	0.77	0.36	0.27	0.15	0.54

APPENDIX C: ECONOMIC ANALYSIS OF ROAD SUBCOMPONENT

Table C-1: Economic Investment Cost

Component	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 30%	Balance Local Cost	Taxes 17%	Other Costs	Foreign x SERF 1.01	Unskilled x SWRF 0.67	Other Cost x 1.00	Economic Project Cost
Civil Works	195.91	18.22	177.69	53.31	124.38	21.14	103.24	18.46	35.72	103.24	157.41
Materials & Equipment	-	-	-	-	-	-	-	-	-	-	-
Engineering	11.77	-	11.77	3.53	8.24	1.40	6.84	-	2.37	6.84	9.21
Consultants	2.70	2.70	-	-	-	-	-	2.74	-	-	2.74
Land, Resettlement	60.00	-	60.00	18.00	42.00	7.14	34.86	-	12.06	34.86	46.92
Base Cost	270.39	20.92	249.46	74.84	174.62	29.69	144.94	21.20	50.14	144.94	216.28
Physical Contingency	27.04	2.09	24.95	7.48	17.46	2.97	14.49	2.12	5.01	14.49	21.63
Total Cost	297.42	23.01	274.41	82.32	192.09	32.65	159.43	23.32	55.16	159.43	237.90

Table C-2: Economic O&M Cost

Component	**2017 Year 3**	**2018 Year 4**	**2019 Year 5**	**2020 Year 6**	**2021 Year 7**	**2022 Year 8**	**2023 Year 9**	**2024 Year 10**	**2025 Year 11**	**2030 Year 16**	**2035 Year 21**	**2040 Year 26**
Staff, Road Repair	2.38	2.38	2.00	2.15	2.32	2.50	4.95	2.91	3.15	4.72	7.21	20.16
Bridge Maintenance	1.19	1.19	0.01	0.01	0.01	0.01	0.06	0.01	0.01	0.01	0.01	0.11
Total O&M cost	3.57	3.57	2.01	2.16	2.33	2.51	5.01	2.92	3.16	4.73	7.22	20.27

Table C-3: EIRR and Sensitivity Analysis

Year	Benefits	Costs			Net Inflow (Outflow)						
	Time Savings	Total	Capital	O&M	Base Case	Cap Cost + 20%	O&M Cost + 20%	Total Cost + 20%	Benefit - 20%	Total Cost + 20%	Benefits - Delay by 1-year
2015	-	-	-	-	-	-	-	-	-	-	-
2016	-	118.95	118.95	-	- 118.95	- 142.74	- 118.95	- 142.74	- 118.95	- 142.74	- 118.95
2017	16.63	122.52	118.95	3.57	- 105.89	- 129.68	- 106.60	- 130.39	- 109.22	- 133.72	- 122.52
2018	17.88	3.57	-	3.57	14.31	14.31	13.60	13.60	10.73	10.02	13.06
2019	26.35	2.01	-	2.01	24.34	24.34	23.94	23.94	19.07	18.67	15.87
2020	28.32	2.16	-	2.16	26.16	26.16	25.73	25.73	20.50	20.07	24.19
2021	30.09	2.33	-	2.33	27.77	27.77	27.30	27.30	21.75	21.28	26.00
2022	31.60	2.51	-	2.51	29.09	29.09	28.59	28.59	22.77	22.27	27.59
2023	33.18	5.01	-	5.01	28.17	28.17	27.17	27.17	21.53	20.53	26.59
2024	48.59	2.92	-	2.92	45.67	45.67	45.09	45.09	35.95	35.37	30.26
2025	51.02	3.16	-	3.16	47.87	47.87	47.23	47.23	37.66	37.03	45.44
2026	53.58	3.42	-	3.42	50.16	50.16	49.47	49.47	39.44	38.76	47.61
2027	56.25	3.70	-	3.70	52.55	52.55	51.81	51.81	41.30	40.56	49.87
2028	59.07	10.15	-	10.15	48.91	48.91	46.88	46.88	37.10	35.07	46.10
2029	78.36	4.36	-	4.36	74.01	74.01	73.13	73.13	58.33	57.46	54.71
2030	82.28	4.73	-	4.73	77.55	77.55	76.60	76.60	61.09	60.15	73.63
2031	86.40	5.14	-	5.14	81.25	81.25	80.23	80.23	63.97	62.95	77.14
2032	90.72	5.59	-	5.59	85.12	85.12	84.00	84.00	66.98	65.86	80.80
2033	95.25	10.17	-	10.17	85.08	85.08	83.04	83.04	66.03	63.99	80.54
2034	100.01	6.63	-	6.63	93.39	93.39	92.06	92.06	73.39	72.06	88.63
2035	105.01	7.22	-	7.22	97.80	97.80	96.35	96.35	76.79	75.35	92.80
2036	110.26	7.87	-	7.87	102.40	102.40	100.82	100.82	80.34	78.77	97.15
2037	115.78	8.58	-	8.58	107.20	107.20	105.48	105.48	84.04	82.33	101.68
2038	121.57	20.27	-	20.27	101.29	101.29	97.24	97.24	76.98	72.93	95.51
2039	127.65	20.27	-	20.27	107.37	107.37	103.32	103.32	81.84	77.79	101.29
2040	134.03	20.27	-	20.27	113.76	113.76	109.70	109.70	86.95	82.90	107.37
EIRR					15.9%	13.8%	15.7%	13.6%	13.1%	11.0%	14.0%
ENPV	283.36	206.52	179.50	27.02	76.84	40.94	71.44	35.54	20.17	- 21.13	40.20
Sensitivity Indicator											
EIRR						2.66	0.33	2.96	3.59	6.30	1.82
ENPV						2.34	0.35	2.69	3.69	6.38	1.76
Switching Value											
EIRR						0.38	3.02	0.34	0.28	0.16	0.55
ENPV						0.43	2.84	0.37	0.27	0.16	0.57

APPENDIX D: ECONOMIC ANALYSIS OF WATER SUPPLY AND SANITATION SUBCOMPONENT

Table D-1: Economic Investment Cost – Water Supply

Component	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 30%	Balance Local Cost	Taxes 17%	Other Costs	Foreign x SERF 1.01	Unskilled x SWRF 0.67	Other Cost x 1.00	Economic Project Cost
Civil Works	166.35	15.47	150.88	45.26	105.61	17.95	87.66	15.67	30.33	87.66	133.66
Materials & Equipment	62.68	31.34	31.34	9.40	21.94	3.73	18.21	31.75	6.30	18.21	56.26
Survey, Design, Supervision	12.47	-	12.47	3.74	8.73	1.48	7.24	-	2.51	7.24	9.75
Consultants	2.70	2.70	-	-	-	-	-	2.74	-	-	2.74
Land	1.00	-	1.00	0.30	0.70	0.12	0.58	-	0.20	0.58	0.78
Base Cost	245.20	49.51	195.69	58.71	136.98	23.29	113.69	50.16	39.33	113.69	203.19
Physical Contingency	24.52	4.95	19.57	5.87	13.70	2.33	11.37	5.02	3.93	11.37	20.32
Total Cost	269.72	54.47	215.26	64.58	150.68	25.62	125.06	55.18	43.27	125.06	223.51

Table D-1a: Economic Investment Cost – Sanitation

Component	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 4000%	Balance Local Cost	Taxes 2%	Other Costs	Foreign x SERF 50.00	Unskilled x SWRF 0.00	Other Cost x 1.00	Economic Project Cost
Civil Works	339.36	31.56	307.80	92.34	215.46	36.63	178.83	31.97	61.87	178.83	272.67
Materials & Equipment	65.07	32.53	32.53	9.76	22.77	3.87	18.90	32.96	6.54	18.90	58.40
Survey, Design, Supervision	21.47	-	21.47	6.44	15.03	2.56	12.48	-	4.32	12.48	16.79
Consultants	2.70	2.70	-	-	-	-	-	2.74	-	-	2.74
Land	25.50	-	25.50	7.65	17.85	3.03	14.82	-	5.13	14.82	19.94
Base Cost	454.10	66.80	387.30	116.19	271.11	46.09	225.02	67.67	77.85	225.02	370.54
Physical Contingency	45.41	6.68	38.73	11.62	27.11	4.61	22.50	6.77	7.78	22.50	37.05
Total Cost	499.51	73.48	426.03	127.81	298.22	50.70	247.53	74.44	85.63	247.53	407.60

Table D-2: Economic O&M Cost – Water Supply and Sanitation

Particulars	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Water Supply	1.16	1.19	1.23	1.27	1.30	1.34	1.38	1.42	1.47	1.70	1.97	2.29
Salaries	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.15	0.18	0.21
Power	0.66	0.68	0.70	0.72	0.74	0.76	0.78	0.81	0.83	0.96	1.12	1.29
Treatment	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Maintenance	0.32	0.33	0.34	0.35	0.36	0.37	0.39	0.40	0.41	0.47	0.55	0.64
Miscellaneous	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.09	0.11
Distribution pipelines	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Wastewater	0.81	0.83	0.86	0.88	0.91	0.94	0.97	0.99	1.02	1.19	1.38	1.60
Salaries	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08
Power	0.26	0.27	0.28	0.29	0.30	0.31	0.31	0.32	0.33	0.39	0.45	0.52
Treatment	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.16	0.18
Maintenance	0.33	0.34	0.35	0.36	0.37	0.38	0.40	0.41	0.42	0.49	0.56	0.65
Miscellaneous	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.07
Collection pipelines	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.09

Table D-3: EIRR and Sensitivity Analysis – Water Supply and Sanitation

Year	Benefits				Costs			Net Inflow (Outflow)						
	Total	Resource Cost Savings	Incremental Consumptn	Improved Health	Total	Capital	O&M	Base Case	Cap Cost + 10%	O&M Cost + 10%	Total Cost + 10%	Benefit - 10%	Benefits - Total Cost + 10%	Delay by 1-year
2015	-				77.77	77.77		- 77.77	- 85.55	- 77.77	- 85.55	- 77.77	- 85.55	- 77.77
2016	-				130.96	130.96		- 130.96	- 144.05	- 130.96	- 144.05	- 130.96	- 144.05	- 130.96
2017	-				215.16	215.16		- 215.16	- 236.68	- 215.16	- 236.68	- 215.16	- 236.68	- 215.16
2018	-				132.97	132.97		- 132.97	- 146.26	- 132.97	- 146.26	- 132.97	- 146.26	- 132.97
2019	-				74.24	74.24		- 74.24	- 81.67	- 74.24	- 81.67	- 74.24	- 81.67	- 74.24
2020	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	- 26.13
2021	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2022	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2023	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2024	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2025	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2026	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2027	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2028	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2029	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2030	171.62	21.61	149.93	0.08	140.79	114.66	26.13	30.83	19.37	28.22	16.75	13.67	- 0.41	30.83
2031	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2032	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2033	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2034	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2035	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2036	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2037	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2038	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2039	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2040	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
EIRR								15.7%	14.4%	15.5%	14.2%	14.0%	12.5%	13.5%
ENPV	736	163	1,134	1	584	512	198	152	105	141	94	78	20	65
Sensitivity Indicator														
EIRR									3.54	0.68	4.20	4.63	8.71	2.90
ENPV									3.11	0.74	3.85	4.85	8.69	2.77
Switching Value														
EIRR									0.28	1.46	0.24	0.22	0.11	0.34
ENPV									0.32	1.36	0.26	0.21	0.12	0.36

APPENDIX E: ECONOMIC ANALYSIS OF OVERALL PROJECT

Table E-1: Consolidated EIRR and Sensitivity Analysis

	Benefits					Costs					Net Inflow (Outflow)				
Year	Total	ITS	TVET	Roads	Water	Total	ITS	TVET	Roads	Water	Base Case	Overall Costs + 20%	Overall Benefits - 20%	Benefits - & Total Cost + 20%	Delay by 1-year
2015	-	-	-	-	-	81	-	3.6	-	78	(81)	(98)	(81)	(98)	(81)
2016	-	-	-	-	-	273	20.0	3.6	119.0	131	(273)	(328)	(273)	(328)	(273)
2017	18	1.1	-	17	-	366	24.3	3.9	122.5	215	(348)	(421)	(352)	(425)	(366)
2018	22	3.8	-	18	-	145	4.3	4.4	3.6	133	(124)	(153)	(128)	(157)	(128)
2019	32	5.6	-	26	-	86	4.3	5.9	2.0	74	(54)	(72)	(61)	(78)	(65)
2020	208	8.2	-	28	172	35	4.3	2.3	2.2	26	173	166	132	125	(3)
2021	211	9.2	0.5	30	172	35	4.3	2.3	2.3	26	176	169	134	127	173
2022	215	10.2	1.5	32	172	35	4.3	2.3	2.5	26	180	173	137	130	176
2023	220	11.3	3.7	33	172	38	4.3	2.3	5.0	26	182	175	138	131	177
2024	239	12.5	6.5	49	172	36	4.3	2.3	2.9	26	204	197	156	149	184
2025	248	13.9	11.0	51	172	36	4.3	2.3	3.2	26	212	204	162	155	203
2026	258	15.4	17.2	54	172	36	4.3	2.3	3.4	26	222	214	170	163	211
2027	268	17.1	23.3	56	172	36	4.3	2.3	3.7	26	232	225	178	171	221
2028	279	18.9	29.2	59	172	43	4.3	2.3	10.2	26	236	227	180	172	225
2029	305	21.0	34.2	78	172	37	4.3	2.3	4.4	26	268	261	207	200	242
2030	316	23.3	39.0	82	172	152	4.3	2.3	4.7	141	164	134	101	70	153
2031	321	24.4	39.0	86	172	38	4.3	2.3	5.1	26	284	276	219	212	278
2032	327	25.7	39.0	91	172	38	4.3	2.3	5.6	26	289	281	223	216	283
2033	333	26.9	39.0	95	172	43	4.3	2.3	10.2	26	290	281	223	215	284
2034	339	28.3	39.0	100	172	39	4.3	2.3	6.6	26	300	292	232	224	293
2035	345	29.7	39.0	105	172	40	4.3	2.3	7.2	26	305	297	236	228	299
2036	352	31.2	39.0	110	172	41	4.3	2.3	7.9	26	311	303	241	233	305
2037	359	32.7	39.0	116	172	41	4.3	2.3	8.6	26	318	310	246	238	311
2038	367	34.4	39.0	122	172	53	4.3	2.3	20.3	26	314	303	240	230	306
2039	374	36.1	39.0	128	172	53	4.3	2.3	20.3	26	321	311	246	236	314
2040	383	37.9	39.0	134	172	53	4.3	2.3	20.3	26	330	319	253	242	321
EIRR											16.3%	13.6%	13.0%	10.4%	14.1%
ENPV	1,169	77	72	283	736	873	57	25	207	584	296	122	62	(112)	153
Sensitivity Indicator															
EIRR												3.2	3.9	6.8	2.0
ENPV												2.9	3.9	6.9	1.9
Switching Value															
EIRR												0.3	0.3	0.1	0.5
ENPV												0.3	0.3	0.1	0.5

APPENDIX F: LEAST COST ANALYSIS

1. Background and Summary

1. In the feasibility study report (FSR), the local design institute (LDI) proposes a number of alternative options of the sites, road pavement materials, water and wastewater treatment processes, pipeline materials, pumping series numbers etc.

2. The LDI weighs the options against each other in terms of technological advantages and convenient construction and easy management. ADB further requires the least cost options are identified, which is taken into consideration in selection of options.

3. For the Project, there are five components / subcomponents in five sectors, i.e. road, water supply, wastewater treatment, intelligent transport and capacity building. They are shown in **Table F-1.**

Table F-1: The Scope and Characteristics of components / subcomponents

Component / subcomponent	Characteristics
Wastewater	Capacity 35,000 m^3/d, pipeline 46.035 km
Water supply	Capacity 60,000 m^3/d, transmission pipeline 14.4 km, distribution pipeline 13.97 km
Road	1 road, red line width 50 m, length 6.022 km
Intelligent transport system	**Traffic police commanding center system**: 1 traffic police commander platform, 61 adaptive traffic signal control systems, 10 electronic police devices, 50 traffic video surveillance systems and 9 traffic guidance mechanisms **Public transport information center system**: infrastructure construction of the center, 1 intelligent transport scheduling and operations management system, 200 station equipment, vehicle equipment and 1 public traffic information service system
Capacity building	**Technical and vocational education and training, environmental management, institutional capacity building**

4. The TA Consultants evaluated all the options identified by the LDI in view of engineering and technology. The ITS component is in line with national and Baiyin municipal development strategy on intelligent traffic management. This component will significantly reduce traffic accidents, injuries, deaths and property damage. The traffic police command center will improve comprehensive traffic management and command for Baiyin District. The LDI and TA Consultants have analyzed in detail the contents of this component. There are no other engineering options; the component's cost effectiveness depends on the rationality and advantages of the content and scheme. The capacity building component is in line with the objective of industrial transformation and upgrading for Baiyin Municipality. This component consists of technical and vocational education, environmental management and institutional capacity building. All of the items in this component are important for Baiyin's sustainable development and necessary for the whole Project's benefits. The FSR has given very specific and detailed analysis in rationality, objectives and contents. Therefore, for the ITS component and capacity building components, LCA is not necessary. For other subcomponents, **Table F-2** lists the options on which LCA has been carried out. There are more options in the FSR than what are listed. These options are chosen due to their overwhelming technological merits, thus no LCA has been carried out for them.

Table F-2: Options for least cost analysis

Component	Subcomponent	Item	Option
Liuchuan industrial park infrastructure	Wastewater treatment	Sewage pipeline	Option 1: RCP Option 2: HDPE pipe Option 3: GRP
		Wastewater treatment process	Option 1: Improved A^2O Option 2: CASS Option 3: G-BAF
	Water supply	Pump series	Option 1: Single-stage Option 2: Double-stage
		Distribution pipeline	Option 1: DIP Option 2: RCP
	Road	Road pavement	Option 1: Asphalt Option 2: cement

RCP = reinforced concrete pipe; DIP = ductile iron pipe; HDPE = high-density polyethylene; GRP = glass fiber reinforced concrete; PCCP = prestressed concrete cylinder pipe

5. The LCA results are summarized in **Table F-3.**

Table F-3: Summary of the results of the least cost analysis

Subcomponent	Item	Option	Least cost option	Recommended by the DI
Wastewater treatment	Sewage pipeline	Option 1: RCP	√	√
		Option 2: HDPE		
		Option 3: GRP		
	Wastewater treatment processes	Option 1: G-BAF process	√	√
		Option 2: CASS process		
		Option 3: Improved A/A/O process		
Water supply	Pump series	Option 1: Single-stage	√	√
		Option 2: Double-stage		
	Water distribution pipeline	Option 1: DIP	√	√
		Option 2: PVC-M		
Road	Road pavement	Option 1: Asphalt	√	√
		Option 2: Cement		

2. Methodology, General Parameters, and Assumptions

Methodology

6. Based on the ADB Guidelines on Least Cost and Cost Effective Analysis, there are three different methodologies to perform LCA and they are as follows:

(i) the lowest average incremental economic cost (AIEC);
(ii) the lowest present value of economic costs (PVEC); and
(iii) the equalizing discount rate (EDR).

7. The lowest AIEC and EDR approaches are both adopted for those components whose outputs are measurable (say flow/day). The lowest PVEC approach is chosen when a measurable output is not available. For this project, the measurable outputs of the subcomponents are limited and therefore the lowest PVEC approach has been adopted. All cost analyses are derived from a comparison of “with” and “without project” components with a discounted rate of 12% per annum. The PVEC equalizes the present value of capital investment and O&M costs.

Project Specific Conversion Factors

8. The cost estimates have been broken down for each of the subcomponents in accordance with ADB guidelines for economic analysis, i.e. the capital costs together with O&M

costs. The costs have been further divided into skilled labor, unskilled labor, traded goods, non-traded goods, and taxes. The conversion factor (CF) for each of the cost items has been calculated. The CFs will then be applied to the LCA and economic analysis. The entire life cycle of financial costs of the current designs proposed in the FSR and the life-cycle financial costs of alternatives are converted into economic costs. The CFs of various cost categories are given in **Table F-4.**

Table F-4: Summary of Project Specific Conversion Factors

Item	Component	Category	CF
A	Wastewater Treatment	Civil Works	0.8722
		Equipment	0.8581
		Associated engineering cost	0.9863
		O&M Cost	0.8588
B	Water Supply	Civil Works	0.8688
		Equipment	0.8581
		Associated engineering cost	0.9888
		O&M Cost	0.8569
C	Road	Civil Works	0.8459
		Equipment	0.8581
		Associated engineering cost	0.9936
		O&M Cost	0.8736
D	Intelligent Traffic Management	Civil Works	0.8854
		Equipment	0.8581
		Associated engineering cost	0.9884
		O&M Cost	0.9255
E	Capacity building	Capital cost	0.9406
		O&M Cost	1.0000

Note: TA Consultants' Estimates

9. In addition to the above CFs, other relevant parameters are shown in **Table F-5**.

Table F-5: Other Parameters

Item	Parameter	Source
Shadow Exchange Rate Factor (2003)	=1.0131	ADB guideline
Skilled Labor	=1.0 in domestic price	National guideline
Unskilled Labor	=0.67 in domestic price	National guideline

Note: The parameter assumptions originate from the PRC's national guideline on methodology and parameters for construction projects' economic assessment.

10. Assumptions

(i) LCA only applies to engineering alternatives.
(ii) Under normal operation, the O&M cost is constant in the economic analysis.

11. General Parameters

(i) All estimates are in 2013 prices.
(ii) The economic discounted rate is 12%.
(iii) The period of analysis for each subcomponent includes the construction period and life span of the subcomponent. The life span for each subcomponent is taken as 20 years and the construction period is between 2 and 4 years for different subcomponents.
(iv) Value added taxes for non-tradable and tradable goods are all 17%; customs duty for tradable goods is zero; business tax for construction companies and transport enterprises is 3.44%.
(v) Based on the VAT, 7% is for urban construction maintenance fee and 3% is for education fee.

12. The costs for capital investment and operation/maintenance are estimated by the LDI and have been adopted here as the financial cost for least-cost comparison purposes.

13. Generally, if the LCA can derive capital and O&M costs directly in the portion of changes for the compared options, the results of LCA for compared options will show individual differences more obviously. The DI estimates costs separately in accordance with subprojects. Even the engineering cost of direct construction (say first part cost) can be divided into different construction items (such as treatment works of wastewater treatment plant, and sewage collection pipe network) for each subproject. The costs by technical option for the compared contents of LCA cannot be completely separated; especially the cost of land acquisition and compensation, included in “the project’s other expenses” (say second part cost) generally assessed for one by one subproject. It is difficult to separate this cost in accordance with different construction items.

14. Similarly, O&M estimates are generally required in accordance with the subproject level to forecast the labor quota, water, electricity and materials consumption, maintenance costs and other estimates. It is difficult to estimate O&M costs in accordance with the compared technical options separately for LCA. Therefore, the following LCA were presented with the total cost of each subproject, which includes the cost changes for the compared options.

3. Alternatives Options identified for Least Cost Analysis

15. The project includes four components, which are LIP infrastructure component, ITS component, TVET component, and capacity building component. LIP infrastructure component consists of one wastewater treatment plant and pipeline subcomponent, one water supply plant and pipeline subcomponent and one road subcomponent.

16. The FSR submitted by the LDI has preliminarily identified and evaluated engineering alternatives based on technical analysis. Some comparisons of engineering characteristics and static unit costs such as for per kilometer road or 100 meter pipeline have been conducted for the subcomponents in the FSR. The TA Consultants have proposed alternatives for LCA based on internal discussions as well as discussion with the LDI.

17. According to ADB’s guideline of economic analysis, LCA should be carried out for each subcomponent. The TA Consultants prepare a list of alternatives for LCA.

3.1 Options Analysis for Each Component

3.1.1 LIP infrastructure component

18. This component consists of three subcomponents, the wastewater treatment plant and pipeline subcomponent, water supply plant and pipeline component, and Xihuan Road subcomponent. The options analysis is shown below.

3.1.1.1 Wastewater treatment subcomponent

19. Options comparison includes site selection, choice of pipeline materials and treatment processes optimization.

20. The plant site has been identified at Nanchuan Village, Liuchuan Township of Baiyin Municipality based on LIP Master Plan.

21. Sewage pipeline materials options are selected as below:

Option 1: RCP
Option 2: HDPE pipe

Option 3: Glass fiber reinforced pipe (GRP)

22. Sewage treatment process options are selected as below:

Option 1: Improved A^2O process
Option 2: CASS process
Option 3: G-BAF process

3.1.1.2 Water supply subcomponent

(1) Location selection

23. Natural and geographical conditions determine the water intake location. The subcomponent involves two levels of the water purification plant. Selection criteria for the water intake location are that the sites of the plants should be close to the water intake, the water transfer pipeline should be short, with not much land required and good construction conditions. Besides, the proximity to the water distribution network is an important factor in site optimization. In accordance with the above principles, combined with the master plan of LIP, the FSR recommended a site in the southeast corner of Yuannan 1 road and Jing 2 road, covering 150 mu.

24. The TA Consultants agree with the FSR on the recommended engineering options after site visit. Therefore, there is no need for further detailed LCA.

(2) Selection of water transfer pipeline alignment

25. The options are as below:

- Option 1: Westward along a valley layout to Dasha River, and then northward, with a total pipeline length 14.3 km, and a 205 m long tunnel
- Option 2: Southward along a valley to Xiaochuan, and then westward along Toudaogou Valley, with a total pipeline length of 16.08 km, and a 1.85 km long tunnel
- Option 3: Southward along a valley to south of Xiaochuan, and then to the end of Erdaogou, with a total pipeline length of 15.44 km, and a 3.32 km long tunnel

26. Results of the technical and economic analysis for the above three options are shown in **Table F-6.**

Table F-6: Comparison of Civil work investment of different options (Unit: CNY1,000)

Item	Option 1	Option 2	Option 3
Earth excavation	746.42	868.95	845.68
Rock excavation	276.17	120.34	48.14
Earth backfill	994.18	1,120.31	1,073.52
Mountain stonework	417.31	787.49	386.62
Sand cushion	268.78	316.54	303.94
Valve well	11.1	13.8	13.2
Steel elbow	384.16	470.60	451.39
Steel pipe	5,312.10	6,169.31	5,923.76
Corrosion protection outside PE	124.17	144.20	138.46
Corrosion protection inside PE	100.71	116.96	112.30
Temporary land (cultivated field)	299.99	336.46	323.07
Temporary land	317.07	355.61	341.45
Permanent land	46.60	57.93	55.41
Tunnel	1025	9712.5	17430
Total	10,323.74	20,590.98	27,446.95

27. It is obvious that option 1 has the advantage in investment; it represents a saving of more than 50% compared with option 2 or option 3. While different options have advantages and disadvantages regarding the convenience of construction and operation, option 1 is obviously the best and is thus recommended. No LCA is necessary.

(3) Choice of pressuring pump series

28. With a long water transfer pipeline between the first level and second level water purification plants, and large terrain changes, pumping is one of the key engineering issues.

29. The feasible engineering options are as below:

Option 1: Single-stage pressurized pump station
Option 2: Double-stage pressurized pump station

(4) Water purification process optimization

30. This subcomponent adopts two levels of plants. The first level plant is necessary due to high turbidity of the Yellow River raw water. The FSR considered 1-level, 2-level and 3-level sediment sinks options, and recommended the 2-level sediment sinks option with reference to other water purification plants along the Yellow River nearby. The 2-level plant adopts a normal and conventional process.

(5) Selection of water transfer pipeline materials

31. For water transfer pipeline, steel pipe and ductile iron pipes are the conventional materials used in the PRC. The steel pipe's material cost is higher, but it has good adaptability to complex terrain and high water hammer. In Gansu province, it has been successfully used in various high-lift pumping stations. Therefore, from engineering safety considerations, the FSR recommended the steel pipe material.

(6) Selection of water distribution pipeline materials

32. For water distribution pipeline, some materials such as ductile iron pipe (DIP), reinforced concrete pipe (RCP) and PE pipe are applied very widely. As PE pipe cannot be adapted to the cold weather of Northwest China, the options chosen for LCA are as below:

Option 1: DIP
Option 2: PVC-M

3.1.1.3 Road subcomponent

33. The Xihuan Road's route was identified in the Baiyin traffic master plan revised in 2007. The road width depends on the traffic volume forecast and engineering design standard. Therefore, the LCA focuses at the road pavement materials. The alternatives for road pavement materials are as follows:

Option 1: Asphalt pavement
Option 2: Cement pavement

3.1.2 ITS component

34. Based on the traffic situation and traffic management analysis, the FSR proposed that this component would consist of command center platform systems, adaptive signal control systems, and an electronic police system and HD video capture system monitoring system. The

LDI and TA Consultants consider that this component can be determined according to the traffic management needs without LCA.

3.1.3 TVET and Institutional Strengthening Components

35. These components include software and hardware of technical and vocational education, capacity building and environmental management system. There are almost no engineering works. Therefore, LCA is not necessary.

3.2 Summary of Options for Least Cost Analysis

36. Based on the above analysis, the options for LCA are shown in **Table F-7**.

Table F-7: Summary of Options for Least Cost Analysis

Subcomponent	Item	Option
Wastewater treatment	Sewage pipeline	Option 1: RCP
		Option 2: HDPE pipe
		Option 3: GRP pipe
	Wastewater treatment process	Option 1: G-BAF process
		Option 2: CASS process
		Option 3: Improved A/A/O process
Water supply	Pump series	Option 1: Single-stage
		Option 2: Double-stage
	Water distribution pipeline	Option 1: DIP
		Option 2: PVC-M
Road	Road pavement	Option 1: Asphalt
		Option 2: Cement

37. For the above options of each subcomponent, LCA covering capital investment and life cycle O&M cost has been conducted.

4. Least Cost Analysis

4.1 Wastewater subcomponent: Sewage collection pipeline materials

38. In the FSR, many pipeline materials have been compared and analyzed in technical terms and unit prices. Three pipelines are selected as options for comparison, i.e. RCP, high density polyethylene (HDPE) pipe and GRP pipe.

Option 1: RCP

39. RCP is normally used in deep or poor soil conditions and when the diameter is greater than 400 mm. Its advantages include low price and complete range of pipe specification, so it is universally applied in the sewer system. Its disadvantages include heavy weight, inconvenient installation and poor corrosion resistance.

Option 2: HDPE pipe

40. HDPE pipe is flexible. Its advantages include smooth internal wall, small water head loss, light weight, simple construction, short construction cycle, strong anti-penetration capability, strong internal shock and abrasion resistance, acid resistance, corrosion resistance and strong adaptability to soil, good fracture resistance, and strong adaptability to uneven settlement of the foundation and soil movements. However, its comprehensive cost is high.

Option 3: GRP

41. The advantages of GRP include good corrosion resistance, lightweight, easy transport and installation, low coefficient of friction, high transmission capacity etc. However, its requirements of foundation treatment, backfill soil quality, and backfill compaction density are relatively high. If these requirements are not achieved properly, it may easily lead to pipe deformation, interface damage and other problems affecting the normal use of the pipeline. In practical domestic and international applications, GRP is mainly used for water transmission projects and low-pressure water supply projects. It is more expensive than RCP. Each option has advantages and disadvantages. **Table F-8** presents the options.

Table F-8: Economic cost of wastewater pipeline materials (Unit: CNY1,000)

Cost Category		Option 1: RCP			Option 2:HDPE			Option 3:GRP		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	24,900		18,979	26,654		20,509	26,826		20,659
1.1	Civil work	7,605	0.8722	6,633	7,605	0.8722	6,633	7,605	0.8722	6,633
1.2	Installation	7,988	0.8722	6,967	9,742	0.8722	8,497	9,913	0.8722	8,646
1.3	Equipment associated works	6,268	0.8581	5,379	6,268	0.8581	5,379	6,268	0.8581	5,379
1.4	Cost (excluding IDC)	3,039		2,922	3,039		2,922	3,039		2,922
1.4.1	Insurance	77	0	0	77	0	0	77	0	0
1.4.2	Others	2,962	0.9863	2,922	2,962	0.9863	2,922	2,962	0.9863	2,922
2	Contingency	2,490	1	2,490	2,665	1	2,665	2,683	1	2,683
3	Start-up working capital	60	1	60	60	1	60	60	1	60
4	Subtotal	27,450		21,529	29,380		23,234	29,568		23,401
5	O&M cost	907	0.8588	779	936	0.8588	803	938	0.8588	806

42. As shown in **Table F-9**, option 1, RCP, is the least cost option in terms of the present value of costs. From economic and cost effectiveness aspects, this is recommended.

Table F-9: Present Value of Cost for Wastewater Pipeline Options (Unit: CNY1,000)

No.	Year	Option 1: RCP			Option 2: HDPE			Option 3: GRP		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	10,765		10,765	11,617		11,617	11,701		11,701
2	2016	10,765		10,765	11,617		11,617	11,701		11,701
3	2017		779	779		803	803		806	806
4	2018		779	779		803	803		806	806
5	2019		779	779		803	803		806	806
6	2020		779	779		803	803		806	806
7	2021		779	779		803	803		806	806
8	2022		779	779		803	803		806	806
9	2023		779	779		803	803		806	806
10	2024		779	779		803	803		806	806
11	2025		779	779		803	803		806	806
12	2026		779	779		803	803		806	806
13	2027		779	779		803	803		806	806
14	2028		779	779		803	803		806	806
15	2029		779	779		803	803		806	806
16	2030		779	779		803	803		806	806
17	2031		779	779		803	803		806	806
18	2032		779	779		803	803		806	806
19	2033		779	779		803	803		806	806
20	2034		779	779		803	803		806	806
21	2035		779	779		803	803		806	806
22	2036		779	779		803	803		806	806
NPV	**12%**			**25,569**			**27,348**			**27,522**

4.2 Wastewater subcomponent: Treatment process

43. Three wastewater treatment processes are compared in the LCA for the wastewater subcomponent, i.e. G-BAF, CASS and improved A/A/O process.

Option 1: G-BAF process

44. G-BAF process is an improved BAF (i.e. Biological Aerated Filter) process. It is applicable to treatment of high toxicity, high ammonia nitrogen and refractory organic wastewater. It includes many advantages of the traditional BAF process, and yet optimizes and simplifies its operation control difficulties. At the same time, this process combines highly efficient microbial with immobilization technique, so it has obvious advantages in the speed of biochemical degradation, strong ability of degradation, small scale land occupation and less sludge generation. It has a unique effect on the refractory organics and ammonia nitrogen. Besides the above, it claims less land and can be expanded easily.

Option 2: CASS process

45. CASS (i.e. Cyclic Activated Sludge System) process, also called CAST (Cyclic Activated Sludge Technique) or CASP (Cyclic Activated Sludge Process), is a new process based on improvement of the sequencing batch reactor (SBR) process. It possesses the advantages of the SBR process such as simple composition of the system, flexible operation and good reliability. It is especially suitable for municipal sewage, which requires nitrogen and phosphorus removal.

Option 3: Improved A/A/O process

46. The improved A/A/O process is a type of biochemical treatment process. It aims to improve the effect of nitrogen and phosphorus removal based on clever mending of the conventional A/A/O (anaerobic / anoxic / aerobic) process. The improved A/A/O creates better conditions for phosphorus accumulating bacteria growth, namely, low NO_3-N, low DO, and high ratio of BOD_5/T-P. It also can reduce the unnecessary backflow as much as possible to save power consumption and support convenient management. In LIP, the removal of NH_3-N, T-N, and T-P is required; the improved A/A/O process is a possible option. Each process has advantages and disadvantages. LCA is conducted to help select the right option. **Table F-10** presents the options for wastewater treatment processes.

Table F-10: Economic cost of wastewater treatment process (Unit: CNY1,000)

Cost Category	Option 1: G-BAF			Option 2: CASS			Option 3: improved A/A/O		
	Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1. Capital direct cost	24,900		18,979	26,149		19,780	27,900		20,877
1.1 Civil work	7,605	0.8722	6,633	7,301	0.8722	6,368	8,366	0.8722	7,297
1.2 Installation	7,988	0.8722	6,967	7,668	0.8722	6,688	8,787	0.8722	7,664
1.3 Equipment	6,268	0.8581	5,379	7,835	0.8581	6,724	6,895	0.8581	5,917
1.4 Associated engineering cost (excluding IDC)	3,039		2,922	3,344		3,222	3,852		3,724
1.4.1 Insurance	77	0	0	77	0.0000	0	77	0.0000	0
1.4.2 Others	2,962	0.9863	2,922	3,267	0.9863	3,222	3,776	0.9863	3,724
2. Contingency	2,490	1	2,490	2,615	1	2,615	2,790	1	2,790
3 Start-up working capital	60	1	60	60	1	60	60	1	60
4. Subtotal	27,450		21,529	28,824		22,455	30,750		23,727
5. O&M cost	907	0.8588	779	941	0.8588	808	971	0.8588	834

47. As shown in **Table F-11**, option 1, the G-BAF process, is the least cost option in terms of

the present value of costs and is recommended.

Table F-11: Present value of cost for wastewater process alternatives (Unit: CNY1,000)

No.	Year	Option 1: G-BAF			Option 2: CASS			Option 3: Improved A/A/O		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	10,765		10,765	11,227		11,227	11,864		11,864
2	2016	10,765		10,765	11,227		11,227	11,864		11,864
3	2017		779	779		808	808		834	834
4	2018		779	779		808	808		834	834
5	2019		779	779		808	808		834	834
6	2020		779	779		808	808		834	834
7	2021		779	779		808	808		834	834
8	2022		779	779		808	808		834	834
9	2023		779	779		808	808		834	834
10	2024		779	779		808	808		834	834
11	2025		779	779		808	808		834	834
12	2026		779	779		808	808		834	834
13	2027		779	779		808	808		834	834
14	2028		779	779		808	808		834	834
15	2029		779	779		808	808		834	834
16	2030		779	779		808	808		834	834
17	2031		779	779		808	808		834	834
18	2032		779	779		808	808		834	834
19	2033		779	779		808	808		834	834
20	2034		779	779		808	808		834	834
21	2035		779	779		808	808		834	834
22	2036		779	779		808	808		834	834
NPV	**12%**			25,569			26,642			28,020

4.3 Water supply subcomponent: Pump series

48. Two alternatives have been considered as LCA options, the single-stage and double-stage pumping. The options are as follows.

Option 1: Single-stage pumping

49. This option involves only one water booster pump station in the first level purification plant. The pumping station is designed to lift water up to 146 m. It is equipped with three sets of horizontal single-stage double-suction centrifugal pumps, with two operating and one standby. The pump station house size is 30 m × 9.6 m (length × width), the floor thickness 0.5 m, and sidewall thickness 0.5 m.

50. The single-stage pump option needs to set up three surge tanks ahead of the pipeline of the secondary purification plant. The surge tanks adopt reinforced concrete structures, with an inner diameter of 7 m, wall thickness of 0.5 m, and height of 10 m.

Option 2: Double-stage pumping

51. This option involves two pumping stations. One station is located in the first-stage purification plant. The first pumping station is located in first-class purification plant.

52. This pumping station's design lift water head is 63 m. It is equipped with three sets of horizontal single-stage double-suction centrifugal pumps, with two operating and one standby. The pumping station size is 26 m × 9.0 m (length × width), floor thickness 0.5 m, and sidewall thickness 0.5 m.

53. The secondary booster pump station is located near 6+500. The pumping head designed is 84 m. This station is equipped with three sets of horizontal single-stage double-suction centrifugal pumps, with two operating and one standby. The size of this pumping station is 28 m × 9.6 m (length × width), the floor thickness 0.5 m, and the sidewall thickness 0.5 m. **Table F-12** presents the options for pump series.

Table F-12: Economic Cost of Water Supply for Pump Series Alternatives (Unit: CNY1,000)

Cost Category		Option 1: Single-stage			Option 2: Double-stage		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	47,729		35,971	47,877		36,100
1.1	Civil work	19,473	0.8688	16,918	19,635	0.8688	17,059
1.2	Installation	15,504	0.8688	13,470	15,504	0.8688	13,470
1.3	Equipment associated	6,507	0.8581	5,583	6,493	0.8581	5,571
1.4	Engineering cost (excluding IDC)	6,246		6,032	6,246		6,032
1.4.1	Insurance	145	0	0	145	0	0
1.4.2	Others	6,101	0.9888	6,032	6,101	0.9888	6,032
2	Contingency	4773	1	4773	4788	1	4788
3	Start-up working capital	110	1	110	110	1	110
4	Subtotal	52612		40854	52775		40998
5	O&M cost	2256	0.8569	1933	2254	0.8569	1931

54. As shown in **Table F-13**, the two options are very similar in terms of the present value of economic cost. However, the single-stage pump option has advantages of easy maintenance, convenient operation and marginal saving cost. So the single-stage option is recommended.

Table F-13: Present value of cost of pump series options for water supply (Unit: CNY1,000)

No.	Year	Option 1: Single-stage			Option 2: Double-stage		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	12,256		12,256	12,299		12,299
2	2016	16,342		16,342	16,399		16,399
3	2017	12,256	1,353	13,610	12,299	1,352	13,651
4	2018		1,933	1,933		1,931	1,931
5	2019		1,933	1,933		1,931	1,931
6	2020		1,933	1,933		1,931	1,931
7	2021		1,933	1,933		1,931	1,931
8	2022		1,933	1,933		1,931	1,931
9	2023		1,933	1,933		1,931	1,931
10	2024		1,933	1,933		1,931	1,931
11	2025		1,933	1,933		1,931	1,931
12	2026		1,933	1,933		1,931	1,931
13	2027		1,933	1,933		1,931	1,931
14	2028		1,933	1,933		1,931	1,931
15	2029		1,933	1,933		1,931	1,931
16	2030		1,933	1,933		1,931	1,931
17	2031		1,933	1,933		1,931	1,931
18	2032		1,933	1,933		1,931	1,931
19	2033		1,933	1,933		1,931	1,931
20	2034		1,933	1,933		1,931	1,931
21	2035		1,933	1,933		1,931	1,931
22	2036		1,933	1,933		1,931	1,931
NPV	**12%**			49,049			49,165

4.4 Water supply subcomponent: Distribution pipeline

55. The LDI proposes two types of pipeline, i.e. DIP and mixed pipeline of PVC-M.

Option 1: DIP

56. DIP is made of cast iron with rough interior. It needs corrosion prevention measures. Rubber gasket is used to connect the pieces together; it seals the pipeline very well but has a short economic life. It is easy to install and can support a pressure of 1.2 MPa. The connection is bendable but the pipeline itself is not.

Option 2: PVC-M pipe

57. The PVC-M pipeline is a modified form of PVC. It possesses the advantages of PE; it is elastic and bendable. It also possesses the advantages of UPVC in installation, easy maintenance etc. Each option has its advantages and disadvantages in technical terms. LCA can help the selection. **Table F-14** presents the options for pipe materials.

Table F-14: Economic cost of pipeline materials options for water supply (Unit: CNY1,000)

	Cost Category	Option 1: DIP			Option 2: PVC-M		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	47,729		35,971	50,541		38,414
1.1	Civil work	19,473	0.8688	16,918	19,473	0.8688	16,918
1.2	Installation	15,504	0.8688	13,470	18,315	0.8688	15,912
1.3	Equipment	6,507	0.8581	5,583	6,507	0.8581	5,583
1.4	Associated engineering cost (excluding IDC)	6,246		6,017	6,246		6,017
1.4.1	Insurance	145	0	0	145	0	0
1.4.2	Others	6,101	0.9863	6,017	6,101	0.9863	6,017
2	Contingency	4,773	1	4,773	5,054	1	5,054
3	Start-up working capital	110	1	110	110	1	110
4	Subtotal	52,612		40,854	55,705		43,578
5	O&M cost	2,256	0.8569	1,933	2,437	0.8569	2,088

58. As shown in **Table F-15**, option 1, DIP material, is obviously cheaper than option 2, PVC-M material, by CNY3.436 million and by 6.5% in terms of the economic present value of cost. It is the least cost option and is recommended.

Table F-15: Present value of cost for water supply pipeline materials (CNY1,000)

No.	Year	Option 1: DIP			Option 2: PVC-M		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	12,256		12,256	13,073		13,073
2	2016	16,342		16,342	17,431		17,431
3	2017	12,256	1,353	13,610	13,073	1,462	14,535
4	2018		1,933	1,933		2,088	2,088
5	2019		1,933	1,933		2,088	2,088
6	2020		1,933	1,933		2,088	2,088
7	2021		1,933	1,933		2,088	2,088
8	2022		1,933	1,933		2,088	2,088
9	2023		1,933	1,933		2,088	2,088
10	2024		1,933	1,933		2,088	2,088
11	2025		1,933	1,933		2,088	2,088
12	2026		1,933	1,933		2,088	2,088
13	2027		1,933	1,933		2,088	2,088
14	2028		1,933	1,933		2,088	2,088
15	2029		1,933	1,933		2,088	2,088
16	2030		1,933	1,933		2,088	2,088
17	2031		1,933	1,933		2,088	2,088
18	2032		1,933	1,933		2,088	2,088
19	2033		1,933	1,933		2,088	2,088
20	2034		1,933	1,933		2,088	2,088
21	2035		1,933	1,933		2,088	2,088
22	2036		1,933	1,933		2,088	2,088
NPV	12%			49,049			52,485

4.5 Road subcomponent: Pavement material

Option 1: Asphalt pavement

59. Asphalt pavement is elastic to some extent, which has advantages of being (i) not sensitive to over-weight trucks; (ii) comfortable for drivers; (iii) with less noise; and (iv) easy to maintain and repair. However, its capacity to support heavy-weight loads is relatively low. It needs repair more frequently, and it is sensitive to temperature and water (flood).

Option 2: Cement pavement

60. Cement pavement can support heavyweight trucks. It is not sensitive to temperature, water, oil, and other erosive chemicals. It needs repair less frequently. However, the joint often breaks and it is not very comfortable for drivers. It has more noise. Each option has advantages and disadvantages in technical terms. LCA will help in the selection of the pavement material. **Table F-16** presents the pavement options.

Table F-16: Economic cost of pavement options for road (Unit: CNY1,000)

Cost Category		Option 1: Asphalt			Option 2: Cement		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	27,166		16,575	28,216		17,431
1.1	Civil work	15,574	0.8459	13,174	16,587	0.8459	14,031
1.2	Installation	3,756	0.8459	3,177	3,756	0.8459	3,177
1.3	Equipment	261	0.8581	224	261	0.8581	224
1.4	Associated engineering cost (excluding IDC)	7,575		7,478	7,613		7,516
1.4.1	Insurance	49	0	0	49	0	0
1.4.2	Others	7,526	0.9936	7,478	7,564	0.9936	7,516
2.	Contingency	2,717	1	2,717	2,818	1	2,818
3.	Start-up working capital	0	1	0	0	1	0
4.	Subtotal	29,883		19,292	31,034		20,249
5.	O&M cost	186	0.8736	162	257	0.8736	224

61. As shown in **Table F-17**, the present value of costs of option 1, asphalt pavement, is lower than that of option 2, cement pavement. The asphalt pavement is the least cost option. In addition, asphalt pavement has the advantages of easy maintenance and riding that is more comfortable. So it is recommended.

Table F-17: Present value of cost of pavement materials for road (Unit: CNY1,000)

No.	Year	Option 1: Asphalt			Option 2: Cement		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	6,431		6,431	6,750		6,750
2	2016	6,431		6,431	6,750		6,750
3	2017	6,431		6,431	6,750		6,750
4	2018		162	162		224	224
5	2019		162	162		224	224
6	2020		162	162		224	224
7	2021		162	162		224	224
8	2022		394	394		467	467
9	2023		162	162		224	224
10	2024		162	162		224	224
11	2025		162	162		224	224
12	2026		162	162		224	224
13	2027		394	394		467	467
14	2028		162	162		224	224
15	2029		162	162		224	224
16	2030		162	162		224	224
17	2031		162	162		224	224
18	2032		394	394		467	467
19	2033		162	162		224	224
20	2034		162	162		224	224
21	2035		162	162		224	224
22	2036		162	162		224	224
NPV	12%			18,450			19,681

LINKED DOCUMENT 7
COUNTRY ECONOMIC INDICATORS

Item	Fiscal Year 2008	2009	2010	2011	2012
A. Income and Growth					
1. GDP per capita ($, current)	3,413.6	3,748.7	4,433.9	5,449.6	6,093.6
2. GDP growth (%, in constant prices)	9.6	9.2	10.4	9.3	7.6
a. Agriculture	5.4	4.2	4.3	4.3	4.5
b. Industry	9.9	9.9	12.3	10.3	8.1
c. Services	10.4	9.6	9.8	9.4	8.1
B. Saving and Investment					
(% of GDP, current prices)					
1. Gross domestic investment	44.0	48.2	48.2	48.4	49.8
2. Gross domestic saving	51.1	50.3	51.7	52.5	51.8
C. Money and Inflation					
(annual % change)					
1. Consumer Price Index	5.9	(0.7)	3.3	5.4	2.6
2. Liquidity (M2)	17.8	27.6	19.7	13.6	13.8
D. Government Finance (% of GDP)					
1. Revenue and grants	19.5	20.1	20.7	22.0	22.6
2. Expenditure and onlending	19.9	22.4	22.4	23.1	24.2
3. Overall fiscal surplus (deficit)	(0.4)	(2.3)	(1.7)	(1.1)	(1.6)
E. Balance of Payment					
1. Merchandise trade balance (% of GDP)	8.0	4.9	4.0	2.8	2.6
2. Current account balance (% of GDP)	9.3	4.9	4.0	2.8	2.6
3. Merchandise export ($) growth (annual % change)	17.6	(16.1)	31.4	20.4	8.0
4. Merchandise import ($) growth (annual % change)	18.8	(11.2)	39.1	25.1	4.4
F. External Payments Indicators					
1. Gross official reserves (excluding gold, $ million in weeks of current year's imports of goods)	1,966,200	2,453,200	2,914,200	3,255,800	3,352,300
2. External debt service (% of exports of goods and services)	1.8	2.9	1.6	1.7	2.0
3. External debt (% of GDP)	11.2	9.5	11.0	11.7	11.6
G. Memorandum Items					
1. GDP (current prices, CNY billion)	31,404.5	34,090.3	40,151.3	47,310.4	51,932.2
2. Exchange rate (CNY/US$, average)	6.9	6.8	6.8	6.5	6.3
3. Population (mid-year, million)	1,324.7	1,331.3	1,337.7	1,344.1	1,350.7

GDP = gross domestic product, () = negative.
Sources: *Asian Development Outlook* database.

LINKED DOCUMENT 8
SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

Country:	People's Republic of China	Project Title:	Gansu Baiyin Integrated Urban Development Project
Lending/Financing Modality:	Project	Department/ Division:	East Asia Department Urban and Social Sectors Division

I. POVERTY AND SOCIAL ANALYSIS AND STRATEGY

Targeting classification: General intervention

A. Links to the National Poverty Reduction and Inclusive Growth Strategy and Country Partnership Strategy

Baiyin Municipality is located in the upper Yellow River and central Gansu Province, one of the 12 less-developed provinces and autonomous regions targeted under the Western Region Development Strategy of the People's Republic of China (PRC). It has a land area of 21,200 km^2 with a total population of 1.74 million and poverty incidence of 30.27% in 2012. The main project area is located in a 23-km^2 planned area of Liuchuan Industrial Park (LIP) of the poverty-stricken Jingyuan County, Baiyin Municipality. Jingyuan County has the second largest population among the districts and counties of Baiyin Municipality, with a total population of 0.48 million, and poverty incidence of 35.21% in 2012. The industrial and financial crises arising from mineral resource depletion have resulted in the unemployment of numerous workers and a growing urban poor population. The estimated urban unemployment rates of Baiyin Municipality's and Jingyuan County were 22.34% and 22.50% respectively in 2012, among the top four cities in Gansu Province and the PRC. In March 2008, Baiyin Municipality was identified as one of the first resource-depleted cities to be transformed. On this basis, the Gansu Provincial Government promulgated the Urban Transformation Plan of Baiyin Municipality (2010-2020) in 2010, positioning it as a regional economic growth center, an important city of new-type industry in western China, an important ecological barrier in central China, and a base for accepting relocation of industries.

The Project will contribute to poverty reduction through job opportunities creation by development of LIP, labor skill improvement by inclusive TVET program and better living condition by smooth and safe traffic management and service provision. In addition, the Project is expected to promote the economic and social transformation strategy of Baiyin Municipality. The Project is aligned with the PRC Country Partnership Strategy of the Asian Development Bank (ADB), 2011–2015. It also supports ADB's urban sector strategy and the PRC's urbanization strategy. The Project also complies with the state, provincial and municipal policies. In addition, it will promote local economic and social development and poverty reduction greatly by generating a large number of direct and indirect jobs, and offering vocational training.

B. Results from the Poverty and Social Analysis during PPTA or Due Diligence

1. Key poverty and social issues. According to the Outline for Development-oriented Poverty Reduction for China's Rural Areas (2011-2020), there are 14 contiguous destitute regions in the PRC, involving 680 counties. The main part of the Liupanshan contiguous destitute region is in Gansu Province, and 40 of the 61 key counties for development-oriented poverty reduction are in Gansu Province. 3 of these 40 counties are in Baiyin Municipality, namely Jingyuan, Huining and Jingtai Counties.

Based on the current national poverty standard of CNY2,300 per year (farmers' net income), Baiyin's rural poverty incidence (35.86%) and Jingyuan County's rural poverty incidence (37.89%) are much lower than the provincial (67.14%) and much higher than national (15.41%) average rates. The urban poverty incidence of Baiyin and Jingyuan are 10.46% and 14.36% respectively, which is higher than the provincial (8.74%) and national (2.92%) average incidence. The poor population is distributed mainly in extremely dry mountain areas, closed down or reduced capacity coal mines, and sandstorm resettlement areas. The main reasons of poverty are lack of water resources, exposure of areas along the Yellow River to frequent natural disasters, such as hailstones, frosts and sandstorms, and lack of job skills or opportunities. In addition, the rural surplus labor force is about 38,000 in Jingyuan County, and about 4,000 in three townships (Liuchuan, Mitan, and Santan). Farmers who will lose their farmland for LIP construction are estimated to number 5,000.

2. Beneficiaries. Investments by large and medium enterprises in LIP from coastal areas are foreseen in industrial sectors including rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, warehousing, logistics, and construction material industries. These enterprises will generate about 77,000 job opportunities in LIP, together with 8,000 jobs for the services sector. The Project will directly benefit people who will live and work in the new LIP, estimated as 39,000 residents and employees by 2020 and 123,000 residents and employees by 2030, and indirect beneficiaries will be more than 2 million residents from Baiyin District and Jingyuan County. The TVET component will contribute to improved livelihoods for communities impacted by LIP's development, specifically through strengthening employment opportunities through skills training. About 87,000 rural and 6,000 urban residents of Jingyuan County are expected to benefit from the project through increased access to training and employment opportunities in a variety of occupational sectors. In addition, the Intelligent Transport System (ITS) component will benefit 276,500 Baiyin District residents directly through providing smooth, safe and better traffic services.

3. Impact channels. The direct impact will be (i) enhanced public infrastructure and environment for local residents enriching their quality of life, (ii) creation of skilled and unskilled job opportunities during construction and operation of the project, (iii) generation of numerous jobs opportunities by transfer of industrial enterprises in LIP, (iv) inclusiveness of the TVET component targeting urban laid-off workers and rural surplus labor, and (v) provision of smooth traffic, safe travel and good service for Baiyin transportation.

4. Other social and poverty issues. The project municipal and county governments have agreed to provide

necessary public service facilities in LIP as residence needs; such as schools, hospitals, solid waste collection etc. In addition, Jingyuan County will build public rental houses for migrant labor, graduated students and poor employees.

5. Design features. The project design responds to issues raised by the poverty and social assessment. Key design features include (i) creation of job opportunities for the poor and women, (ii) helping local laid-off workers and rural surplus labor grasp new skills and find off-farm jobs, (iii) strengthened public participation and information disclosure, such as project information, LIP master plan and management, and recruitment information, (iv) public awareness education programs such as road safety and environment protection and (v) establishment of a grievance redress mechanism. The actions in the social development action plan (SDAP) and gender action plan (GAP) will mitigate adverse impacts and increase positive impacts of the project. The executing and implementing agencies will implement these plans in collaboration with other stakeholders during project implementation.

II. PARTICIPATION AND EMPOWERING THE POOR

1. Summarize the participatory approaches and the proposed project activities that strengthen inclusiveness and empowerment of the poor and vulnerable in project implementation. Extensive consultations with representatives of affected villages, communities, laid-off workers, rural surplus labor, enterprises and government agencies were conducted during project design. In total, 433 people were surveyed, and 30 focus group discussions (FGDs) with 350 participants were held. In addition, a number of key informant interviews and stakeholders workshops were also held with the executing agency, implementing agencies, and various bureaus during preparation of the resettlement plan and environmental management plan.

2. If civil society has a specific role in the project, summarize the actions taken to ensure their participation.
Baiyin Municipality and Jingyuan County Women's Federations will coordinate with Baiyin project management office (BPMO) and LIP Management Committee (LMC) to assist in organizing several consultative, advocacy, and training activities for the project's subcomponents.

3. Explain how the project ensures adequate participation of civil society organizations in project implementation.
Key informants interviews and workshops during the design were conducted in Baiyin and Jingyuan Women's Federations, who will be further involved in implementation. A suitable budget, monitoring and evaluation, and capacity building activities were designed to support their participation.

4. What forms of civil society organization participation is envisaged during project implementation?
☒ Information gathering and sharing (M) ☒Consultation (M) ☐Collaboration (L) ☐ Partnership

5. Will a project level participation plan be prepared to strengthen participation of civil society as interest holders for affected persons particularly the poor and vulnerable?
☐ Yes. ☒ No. Participation and consultation activities are incorporated into the SDAP and GAP.

III. GENDER AND DEVELOPMENT

Gender mainstreaming category: Effective gender mainstreaming

A. Key issues. According to the Statistical Yearbook 2013 of Gansu Province, the population of Baiyin Municipality was 1.72 million in 2012, of which 48.6% was women. Over the years, women's rights and interests have been well protected and women's development has significantly improved in Baiyin Municipality. 48.2% of employees are women, almost equivalent to the percentage of the female population. However, there are still large gender differences in certain aspects. For example, in Baiyin Municipality, 70% of all community members are women, yet only 14% of all village community committee members are women. Similarly, not more than 15% of leadership members of governments and functional departments at or above the township level are women. Survey and FGD data reveal that among the female respondents (40%), 20% do full-time jobs, 34% do part-time jobs and 46% are unemployed. Most women do not understand the labor law and labor security policies. Most female respondents support the project as it will generate job opportunities through LIP construction, and are willing to work in the chemical industry if the health protection measures are sufficient. In addition, FGDs reveal that women are interested in gaining skills through training that will provide them with better non-farming employment opportunities, and the women consulted consider the improvements in traffic safety and access to transport facilities to be provided under the project as important benefits.

B. Key actions.
☒ Gender action plan ☐ Other actions or measures ☐ No action or measure
The GAP includes specific targets for women in employment, vocational training, and participation and has been assured by the government. In addition to adequate staffing and training for BPMO and the implementing agency, women will be provided with (i) job opportunities during and after project implementation and from enterprises in LIP, (ii) consultation and awareness raising education program, including training on labor law, labor protection and labor security program etc.; (iii) an existing short-term training course to be strengthened, called Chinese bread/noodle making, which almost 100% targets local women; (iv) opportunities to participate in community management and decision-making processes, and (v) opportunities to participate in project design and LIP management. The design and monitoring framework, SDAP, and GAP include sex-disaggregated data and indicators.

IV. ADDRESSING SOCIAL SAFEGUARD ISSUES

A. Involuntary Resettlement **Safeguard Category:** ☒ A ☐ B ☐ C ☐ FI

1. Key impacts. The Project will have significant land acquisition and resettlement impacts, and thus is classified as Category A for the resettlement safeguard. The Project will affect 4 groups of 2 villages in the project area. The Project will permanent occupy 1,158.31 *mu* of state-owned land, acquire 397.74 *mu* of collectively-owned land and demolish 8,252.41 m^2 of rural residential houses, affecting 67 rural households or 337 persons in 2 villages of Jingyuan; among these, 4 households with 20 persons are identified as vulnerable groups. The estimated resettlement cost of the project is CNY96.54 million.

2. Strategy to address the impacts. A resettlement plan was prepared in line with ADB's Safeguard Policy Statement (2009) and relevant laws and regulations of the PRC. The plan was endorsed by BMG and disclosed to the affected people in the local language. All affected assets (permanent and temporary impacts) will be compensated to the affected people at full replacement cost. BPMO will coordinate implementation of the project and report progress to ADB. Land Resources Bureau and LMC in Jingyuan County will carry out land acquisition, house demolition, and implementation of the resettlement plan. A grievance redress procedure has been established for the affected people. BPMO will engage an external monitoring institute to independently verify adherence to provisions of resettlement plan.

3. Plan or other actions

☒ Resettlement plan
☐ Resettlement framework
☐ Environmental and social management system arrangement
☐ No action
☐ Combined resettlement and indigenous peoples plan
☐ Combined resettlement framework and indigenous peoples planning framework
☐ Social impact matrix

B. Indigenous Peoples **Safeguard Category:** ☐ A ☐ B ☒ C ☐ FI

1. Key impacts. Not applicable. Is broad community support triggered? ☐ Yes ☒ No

2. Strategy to address the impacts. Not applicable

3. Plan or other actions

☐ Indigenous peoples plan
☐ Indigenous peoples planning framework
☐ Environmental and social management system arrangement
☐ Social impact matrix
☒ No action
☐ Combined resettlement plan and indigenous peoples plan
☐ Combined resettlement framework and indigenous peoples planning framework
☐ Indigenous peoples plan elements integrated in project with a summary

V. ADDRESSING OTHER SOCIAL RISKS

A. Risks in the Labor Market

1. Relevance of the project for the country's or region's or sector's labor market.

☐ unemployment ☐ underemployment ☐ retrenchment ☒ core labor standards

2. Labor market impact

About 131 skilled and 150 unskilled jobs will be generated in the Project construction stage. 75 skilled jobs and 31 unskilled jobs (maintenance, cleaners, landscaping workers etc.) will be provided in the operation stage. Furthermore, with the LIP construction, more and more enterprises will be attracted; it is expected that enterprises will generate 77,000 job opportunities, and 8,000 jobs created from the services sector in the LIP.

B. Affordability. The water supply and wastewater collection system improvements will result in increased tariffs. Currently the cost is included in the rate for water supply and wastewater treatment, which is CNY2.75/m^3 of water used. An affordability analysis shows that domestic water expenses will account for 1.26% and 0.97% of the income of rural poor and ordinary households respectively. Key measures in the project to address possible exclusion include: (a) loan assurances on (i) maintaining subsidies for poor households and (ii) annual review of tariffs and fees including an assessment on their impact on the poor and; (b) in public hearings for tariff increases, representation of women and the poor among resident representatives, who will number not less than 60% of all participants.

C. Communicable Diseases and Other Social Risks

1. Indicate the respective risks, if any, and rate the impact as high (H), medium (M), low (L), or not applicable (NA): ☒ Communicable diseases (L) ☐ Human trafficking (NA) ☐ Others (please specify)

2. Describe the related risks of the project on people in project area. EMP, GAP, loan assurances, and SDAP require dissemination of information on HIV/AIDS and sexually transmitted infections at construction sites for all new employees upon engagement. This will be done in collaboration with the Center for Disease Control. HIV/AIDS, sexually transmitted infections and other communicable disease clauses will be included in contract bidding documents.

VI. MONITORING AND EVALUATION

1. Targets and indicators: For skilled and unskilled laborers, the targets will be 30% poor and 30% female. For participants in awareness education and other information campaigns, 40% will be female. The design and monitoring framework, GAP and SDAP targets and indicators were discussed and confirmed with BPMO and relevant organizations. A comprehensive project performance monitoring system and the social and gender monitoring indicators were developed to systematically generate data for the social and gender aspects, in consultation with the implementing agency and with the assistance of consultants.

2. Required human resources: A social/gender consultant, a resettlement consultant and TVET consultants are budgeted for the supervision contract. Terms of reference outlining the roles are included in the project administration manual (PAM). GAP and SDAP require staff to be allocated for their oversight and implementation in the BPMO and the executing agency.

3. Information in PAM: The PAM outlines poverty, social and gender issues and includes the SDAP and GAP.

4. Monitoring tools: During project implementation, internal monitoring results of GAP and SDAP will be incorporated in the project performance monitoring system report. Data sources will include (i) project management information system, (ii) official statistics, and (iii) social surveys and researches.

[a] A *mu* is a Chinese unit of measurement (1 *mu* = 666.67 m^2).

LINKED DOCUMENT 9
GENDER ACTION PLAN

Gender Action Plan

Proposed actions	Targets and indicators	Agencies concerned	Timeline	Funding source
Output 1: Liuchuan Industrial Park infrastructure improvement				
● Share LIP master plan and project's detailed design to women and promote their participation during consultation ● Women participate in LIP's community management; ● Disclosure to women on LIP policies and programs on compensation as they are entitled to receive compensation fees ● Public traffic safety awareness and education for residents and employee in LIP ● Public hearing for water supply and wastewater treatment tariff in Jingyuan county	● At least 70% of women around LIP (townships of Liuchuan, Mitan, Santan and Wulan) will be informed. ● 40% female participants ● 100% of affected women are aware of LAR compensation program. ● 30% of women participation ● Participants and elected representatives (sex disaggregated) ● 50% women representatives collect information and comments from community-based focus group discussion	**Responsible agencies**: LMC, design agency, women's federation, and contractor **Assisting agencies**: Baiyin PMO, planning bureau, communities, and enterprises	2014-2016	Jingyuan County Government Project design and construction funds
Output 2: Technical and vocational education and training				
● More access of unemployed workers and surplus labor groups to training and employment opportunities	● At least 30% female teachers will be hired. ● At least 40% female trainees will be enrolled for 3 existing and 5 new short-term training courses by the end of year 5. ● 40% of female instructors will participate in CBT and teaching-learning development activities.	**Responsible agencies**: Jingyuan County Secondary TVET School and county labor and social security bureau **Assisting agencies**: Baiyin PMO, LMC, municipal education bureau, municipal labor and social security bureau, and pertinent enterprises	2014-2019	Budget from capacity building component, and local government funds
● Women are involved in capacity building for development of labor market information and employment services	● Numbers of workshops for BHRSS personnel on data collection and management (40% female participants); ● Numbers of BHRSS personnel receiving training in career guidance (40% female participants)	**Responsible agencies**: Municipal and county labor and social security bureaus **Assisting agencies**: Baiyin PMO and LMC	2014-2019	Budget from capacity building component, and local government funds
● Training course on Chinese bread/noodle making	● 100% of participants are women			
Output 3: Intelligent transport systems				
● Public traffic safety awareness and education for schools and residents in	● 50% female participants ● 30% female participants	**Responsible agencies**: Women's federation and municipal traffic police	2014-2016	CNY20,000/ year x 3 years =

Baiyin ● Public traffic safety awareness and education for drivers		detachment **Assisting agencies**: Mass media, driving schools, and taxi drivers' association		CNY60,000 from local government budget
Output 4: Institutional development				
● Women are involved in institutional strengthening	● Numbers of BHRSS personnel and stakeholders participating in management development workshops (30% female participants) ● Number of persons participating in study tours and exchange of expertise (40% female participants)	**Responsible agencies**: Jingyuan County Secondary TVET School, municipal and county labor and social security bureaus **Assisting agencies**: Baiyin PMO, LMC, municipal education bureau	2014-2019	Budget from capacity building component, and local government funds
For All Outputs				
Project management				
● BPMO and implementing agencies assign persons for implementation and reporting of GAP and SDAP ● A social and gender specialist is recruited to support the implementation of the GAP and SDAP. ● BPMO and implementing agencies' staff are trained to ensure effective project implementation. ● Sex-disaggregated data will be collected to ensure monitoring, evaluation and reporting of GAP and SDAP.	● Number of staff members of the BPMO and implementing agencies responsible for GAP and SDAP reporting ● Indicators involving social development and gender in PPMS ● 100% of staff of BPMO and implementing agencies receive training (at least 30% representatives in all training) ● Women employees in LMC increase from 10% to 30%.	**Responsible agencies**: Baiyin PMO, LMC **Assisting agencies**: Social and gender experts	2014-2018	Budget of the capacity building component CNY50,000/ year x 5 years = CNY250,000
Contractors and enterprises' owners				
● Generate skilled and unskilled jobs at construction and operation stages ● Ensure female workers are aware of the Labor Law ● Ensure female workers sign labor contracts ● Ensure work environment and conditions on construction sites are responsive to women's needs ● Provide separate training on transmission and prevention of HIV/AIDS and sexual harassment for female and male employees.	● 30% of jobs at the construction and operation stages are available to women, and 20% of jobs for enterprises in LIP are provided to women (disaggregated by sex and position). (Baseline for female construction workers: 15%) ● 90% of female workers are aware of the Labor Law, and women's rights and interests. (Baseline: 50%) ● 90% of female workers sign labor contracts. (Baseline: 40%) ● Separate sanitary facilities (toilets) are available for women in all constriction sites	**Responsible agencies**: Baiyin PMO, contractor, enterprises in LIP, labor and social security bureau **Assisting agencies**: Women's federation, communities	2014-2018	Project construction and operation funds Costs of enterprises in LIP

	● 95% women workers attend the HIV/AIDS and sexual harassment training.			

BHRSS = Bureau of Human Resources and Social Security, BPMO = Baiyin Municipal project management office, CBT= competency-based Training, CNY = Yuan, GAP = gender action plan, LAR = land acquisition and resettlement, LIP = Liuchuan Industrial Park, LMC = LIP management committee, PPMS = project performance management system, SDAP = Social Development Action Plan, TVET = technical and vocational education and training.
Source: TA Consultants' estimates

LINKED DOCUMENT 10
INITIAL ENVIRONMENT EXAMINATION

A. Background

1. This Project Initial Environment Examination (project IEE) report was prepared for the proposed Gansu Baiyin Integrated Urban Development Project (the project) in Baiyin Municipality of Gansu Province, the People's Republic of China (PRC). The project IEE is prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the domestic environmental impact assessment (DEIA) prepared by Lanzhou University (the EIA Institute), Feasibility Study Report (FSR) of the project components, water and soil conservation plan, workshop reports, social and economic assessments under the Project Preparatory Technical Assistance (PPTA), and project policy dialogue discussions between the ADB missions, the TA Consultants, Gansu Provincial Government (GPG) and Baiyin Municipal Government (BMG).

2. Baiyin is a medium-sized city in Gansu province (Gansu), one of the 12 less-developed provinces and autonomous regions targeted under the Western Development Strategy of the People's Republic of China (PRC). The city was originally established as a national copper mining base in the 1950s but its socioeconomic development suffered major setbacks after continuous copper exploitation and depletion, and environmental degradation. Since the Eleventh Five-Year Plan 2006–2010, Baiyin received special support from the national and provincial governments to jumpstart its industrial transformation. [1] The goal was to transform Baiyin from a resource-exhausted mining city into a new industrial center through technology upgrading and diversification of existing production chains, while achieving efficient use of resources and reducing adverse impacts on the environment.

3. Baiyin's industrial transformation aims to facilitate inclusive and environmentally sustainable urban development. Although the Phase I project supported Baiyin to start its economic diversification, the city faces emerging urban development challenges. The main project area is located in a 23-km^2 planned area of Liuchuan Industrial Park (LIP Phase 1) of the poverty-stricken Jingyuan County[2], one park of the "one zone and six parks" comprising Baiyin Industrial Concentrated Zone, which is a strategic industrial base of the Lanbai ("Lanzhou–Baiyin") Core Economic Zone. It aims at attracting transfer of large and medium industrial enterprises from the eastern coastal region of the PRC, focusing on rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, warehousing, logistics, and construction material industries. Master planning and regulatory planning of the project area has been completed, and land formation, construction of some roads, a resettlement area, and some industrial plants and ancillary buildings has started.

4. The built-up area of the LIP is currently 5 square kilometers. As of March 2014, 16 enterprises and institutions have settled in the park. The area is spacious, has little value for farming and is close to water sources and power supply. It is a favorable location for industrial zone development. However, to enable large-scale industrial development, the site is in urgent need of infrastructure such as road access, water supply and wastewater treatment.

5. The proposed ADB financed project will invest in a road and key urban infrastructure and services in the area to provide transport, water service for drinking and industrial processing, and wastewater treatment to improve the environment, and locals' quality of life. This will significantly

[1] In 2008, Baiyin was listed as one of 18 national resource-exhausted cities which received special support for economic transformation under the Eleventh Five-Year Plan. Baiyin was also designated as a circular economy pilot city in 2009 and a resource-based city transformation demonstration area in 2011.

[2] Jingyuan County's per capita gross domestic product in 2012 was CNY11,884, 54% of Baiyin's average. Gansu provincial government under its 12 FYP designates the Lanbai Core Economic Zone to accelerate the development of the industrial economic corridor from the provincial capital of Lanzhou to Baiyin.

improve the investment environment to attract more enterprises to move into the project area. Moreover, the development of LIP will provide significant job opportunities.

6. To complement the infrastructure construction for industrial development, the project will also strengthen vocational education and training capacity, enhance environmental management for industrial transformation, and enhance road safety and traffic management in Baiyin District. The project will further scale up the outcome of the Phase I project by accelerating environment-friendly industrial transformation in Baiyin.

B. Project Design

7. **Lessons learned and special features**. The project design incorporates lessons learned from ADB's five urban sector projects in Gansu. These are (i) keeping impacts of land acquisition and resettlement to a manageable level, and (ii) rigorously reviewing technical designs to avoid oversized infrastructures.[3] Together with and building on the Phase I project, the project will demonstrate a sustainable model of urban development through industrial transformation for other resource-exhausted cities in the PRC. Individual special features of the project include: (i) comprehensive support for skills training and vocational education for industrial transformation; (ii) enhanced environmental management through detailed environmental management system (EMS); and (iii) installation of an intelligent transport system (ITS) to address bottlenecks on transportation management.

8. **Impact, Outcome, Outputs.** The impact of the project will be accelerated industrial transformation and economic diversification in Baiyin. The expected outcome will be environmentally sound and socioeconomically inclusive industrial development in Baiyin. Project outputs include:

(i) basic urban infrastructure in LIP Phase 1, comprising: (a) a new water supply facility with treatment capacity of 60,000 cubic meters per day, a 14-kilometer (km) water transmission pipeline, a 9.2-km water distribution pipeline network and other related facilities; (b) a new wastewater treatment facility with treatment capacity of 35,000 cubic meters per day, a 57-km wastewater collection pipeline network and related facilities; and (c) 1 new road of 6 km;

(ii) strengthening of TVET capacities for local skilled/unskilled workers in Jingyuan County;

(iii) ITS in the Baiyin District, including (a) an integrated traffic operation platform; (b) an adaptive signal control system; (c) an electronic-police system; and (d) a comprehensive violation processing system. Also, for medium-term and long-term development, a large-scale traffic data collection and dissemination system will be built; and

(iv) project management and institutional capacity building, including effective project management, environmental management of the industrial area, and the sustainable operation and maintenance of project facilities.

9. The capacity development component will have a subcomponent to assist the LIP achieve sustainable environmental management. The environment management system (EMS) subcomponent will work to ensure that environmental management of the LIP is performed to international best practices and obtain LIP ISO14001 certification as well as "eco-industrial park" status under the Ministry of Environment and NDRC programs. The LIP EMS will serve as a demonstration and model for the many other existing and proposed industrial parks of Baiyin and

[3] ADB assistance associated to urban development in Gansu province include: *Gansu Baiyin Urban Development Project* (Loan 2407-PRC, completed); *Lanzhou Sustainable Urban Transport Project* (Loan 2601-PRC, ongoing); *Gansu Tianshui Urban Infrastructure Development Project* (Loan 2760-PRC, ongoing); *Gansu Urban Infrastructure Development and Wetland Protection Project* (Loan 2903-PRC); and *Gansu Jiuquan Integrated Urban Environment Improvement Project* (Loan 3003-PRC).

Gansu Province. The subcomponent also includes the development of an Emergency Planning and Response Plan for the LIP as well as an Environmental Management Information System (EMIS). Strengthening of TVET provision and related capacities in Baiyin Municipality and Jingyuan County are also included in the design of the project as a sub-component of Capacity Building activities.

10. **Implementation Arrangements.** Baiyin Municipal Government (BMG) is the project executing agency (EA). The EA is responsible for communication with ADB, loan on-lending and repayment, as well as supervision and guidance of the BPMO and LMC during the project implementation. A Project Leading Group (PLG) chaired by the vice mayor of BMG provides overall guidance to the preparation and implementation of the project.

11. The Baiyin Project Management Office (BPMO) will (i) ensure provision of counterpart funding, (ii) engage and supervise engineering and environmental design institutes, tendering company and the project management consulting service during project implementation, and (iii) report on progress. The BPMO assists the EA and its Project Leading Group (PLG) with policy guidance, institutional coordination, and overall monitoring of project progress in accordance with ADB guidelines and Loan Agreement. BPMO is also responsible for the preparation and implementation of the institutional development component.

12. The Liuchuan Industrial Park Management Committee (LMC), Baiyin Municipal Traffic Police Detachment and Baiyin Municipal Public Transport Company, and Baiyin Mining and Metallurgy Professional Technology Institute and Jingyuan County Bureau of Human Resources and Social Security will be the implementing agencies for infrastructure components associated with the LIP, the intelligent transport system (ITS) component, and the technical and vocational education and training (TVET) component respectively.

C. Project Benefits

13. **Direct project beneficiaries**. The implementation of the Project and the development of LIP are expected to generate 70,000 temporary jobs and 92,000 permanent jobs in the long term, benefiting urban and rural surplus labor in Baiyin and Jingyuan County directly. The TVET component will improve local vocational education and provide more skilled labor to LIP. In addition, the ITS component will benefit the urban population of 276,500 of Baiyin directly and a population of over 510,000 in the remainder of Baiyin.

14. **Reduced water pollution.** The project will improve the water quality of the project area and the Dasha River by providing wastewater collection and treatment to the new industries in the LIP. A few existing industries that have inadequate wastewater treatment will now have their wastewater collected and treated properly but there are many pollutant sources along the Dasha River beyond the influence area of the LIP project. Since the proposed wastewater collection and treatment system will mainly service the new LIP tenant industries, the project is mainly avoiding future pollution rather than addressing existing pollution sources. Since 100% reuse of treated wastewater effluent is planned, the degree of pollution avoidance is increased as there will not even be treated effluent impacts to the Dasha River once WWTP is fully operational and reuse systems are in place. The EIA institute estimates that the reduction of COD, BOD_5, ammonia, TN, TP and SS through the proper operation of the WWTP will be 3,832.5 t/a, 1,405.3 t/a, 472.67 t/a, 523.77 t/a, 33.21 t/a and 2,427.3 t/a respectively.

15. **Reliable water supply.** The project water supply subcomponent will increase the capacity and security of water supply to LIP and provide vital support to the development of LIP. Sufficient capacity is being provided for the first phase industries locating in the LIP while nearby villages are being supplied with improved water supply through the Jingyuan County Drinking Water Safety Project that will be completed in 2014. These complementary projects improve industrial water supply and nearby villages for domestic supply.

16. **Air pollution.** In a similar fashion to the water pollution section, the LIP will work to comply with the new Ambient Air Quality Standard GB3095-2012 going into effect in January 2016 by applying best management practices through the LIP EMS. The ITS will enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks thereby reducing traffic-related air pollution.

17. **Water conservation**. The proposed wastewater management scheme for the LIP calls for 100% reuse of WWTP effluent for landscape irrigation and industrial reuse. Other water conservation programs will be encouraged within the various industries through the LIP environmental management system (EMS). The EMS will promote reductions in water use through the application of industrial best management practices and pollution prevention techniques.

18. **Environmental Demonstration Project**. The EMS subcomponent under the project will ensure safe, environmentally friendly and sustainable operations in the LIP. It will enhance environmental management and emergency response capacity of the LIP to minimize environmental pollution and mitigate negative impacts of environmental incidents, and to comply with the final recommendations of the planning EIA that was prepared for the LIP. The mid-term objective (2018) of the subcomponent is to achieve ISO 14001 EMS certification for LMC. The proposed EMS for LIP is intended to contribute to LIP's accreditation as an eco-industrial park under PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009), targeted by 2025.

19. **Poverty and social benefits**. The Project, by its nature of improving environment and public services, is classified as general intervention regarding poverty reduction impact. The Project will not entail disparities and inequalities between the poor and non-poor for their access to the project outputs and the access to the resultant social and economic benefits. The water supply and wastewater treatment facilities will not only serve the industrial park, but also residents within the LIP. By 2030, LIP is expected to offer 92,000 permanent jobs and 70,000 temporary jobs. Over 50% of the local surplus labor will improve their skills and receive new jobs from LIP by receiving different types of vocational training through the TVET project component. The ITS component will generate great social benefits, such as reducing the number of urban traffic violations, and reducing casualties and property losses arising from traffic accidents. It is estimated that the total amount of direct and indirect financial losses arising from traffic accidents and violations in Baiyin City exceeds CNY200 million per year. It is estimated after intelligent traffic management systems are provided, the number of traffic violations will be reduced greatly, thereby reducing financial losses and the probability of major traffic accidents.

20. **Gender benefits.** The project is designed to meet the criteria for effective gender mainstreaming category. Results from the household survey and focus group discussions indicated that improved public infrastructure is an important benefit of the project to women as well as job creation opportunities. The project will significantly improve their access to social services, and provide new employment and income opportunities. The project will be an important way to help the BMG implement their Women's Development Plan of Baiyin (2011-2020), which proposes specific development objectives and strategies in respect of women and health, women and education, women and economy, women's participation in decision-making and management, women and social security, women and environment, and women and law to promote women's development and gender equality.

D. Anticipated Environmental Impacts and Environmental Management Plan

21. The project underwent appraisal during project preparation and was classified as Category B by ADB, requiring an initial environmental examination (IEE). Domestically, the wastewater component and road component were classified as Category A in accordance with the Guideline on EIA Classification for Construction Projects issued by the PRC's Ministry of Environmental Protection (MEP 2008), requiring an environment impact assessment (EIA). The water supply component was Category B, requiring a simplified, tabular environment impact statement. A

consolidated domestic environmental impact assessment (DEIA) was prepared for the entire project. The Gansu environment protection department (GEPD) approved the domestic safeguards documents in June 2014. In addition, a project IEE in English was prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the DEIA prepared by Lanzhou University (the EIA Institute), Feasibility Study Report (FSR) of the project components, water and soil conservation plan, a strategic EIA prepared for the LIP, water resources assessment report, workshop reports, social and economic assessments under the Project Preparatory Technical Assistance (PPTA), and project policy dialogue discussions between the ADB missions, the TA Consultants, Gansu Provincial Government (GPG) and Baiyin Municipal Government (BMG).

22. The potential impacts (positive and negative) and risks were screened during the IEE in order to (i) identify the relative significance of potential impacts from the activities of the proposed infrastructure; (ii) establish the scope of the assessment which assists in focusing on major, critical, and specific impacts; and (iii) enable flexibility in regard to consideration of new issues, such as those reflecting the requirements of both the PRC's environmental laws, regulations and standards, and ADB's Safeguard Policy Statement.

23. **Construction Phase.** The major anticipated impacts caused by the infrastructure component for LIP during construction phase include: noise, air pollution (mainly fugitive dust), wastewater discharge, soil erosion, solid waste disposal, interference with traffic and municipal services, permanent and temporary acquisition of land, involuntary resettlement, and occupational and community health and safety.

24. **Loss of land, resettlement.** In total, the Project will occupy 1,158.31 mu[4] of state-owned land (including 830.96 mu of stated-owned barren hills, 6 mu of irrigated land owned by Lantong Farm, and 321.35 mu of collective-owned land acquired already) and acquire 397.74 mu of collective-owned land permanently, including 286.87 mu of irrigated land, 32.57 mu of housing site land and 78.3 mu of idle land. The Project will affect 3 groups of 2 villages in the project area. A total of 1,019.05 mu will be occupied permanently, including 403.74 mu of collective land and 615.31 mu of state-owned land. 155 mu will be occupied temporarily. A total of 8,074.41 m^2 of residential housing will be demolished, and the Project will affect a total of 111 households/entities with 563 persons. Among these, LA will affect 53 HHs/entities (including one Farm) with 263 persons. House demolition will affect 35 HHs with 156 persons including 23 HHs with 99 persons also affected by land acquisition. Temporary land use will affect 46 HHs with 243 persons, and house demolition will affect 35 households/entities with 156 residents.

25. **Soil erosion prevention measures.** Soil erosion is predicted to be significant during project implementation if no measures are implemented. Contractors will be required to prepare and implement a Site Drainage and Soil Erosion Management Plan in compliance with the engineering and vegetation measures defined in the Water and Soil Conservation Plan. The soil erosion inspection and monitoring program defined in the EMP will confirm adequacy of these measures. The inspection and monitoring results will be submitted to the BPMO, IAs, local EPB and Water Resources Bureau to serve as basis for project implementation progress reports and acceptance of construction.

26. **Surface water pollution**. Inappropriate storage and handling of petroleum products and hazardous materials, or accidental spills, disposal of domestic wastewater from construction camps, and wash-down water from construction equipment and vehicles may contaminate adjacent surface water or groundwater resources. Infrastructure and river intake works, as well as pipeline works, will disturb surface soils and could affect surface water in the project area through increased sedimentation, resulting from cutting and filling operations, excavation of pipeline trenches, and bridge construction across Dasha River. Measures are included in the EMP to protect water bodies from the various infrastructure construction activities including use of

[4] "mu" is a Chinese measuring unit for land and equals 667 square meters.

a Spill Containment Plan, temporary wastewater treatment systems for domestic wastewater and contaminated site runoff, and material storage protection. Water quality (for pollutants such as SS, COD_{Cr}, oil, and grease) in the Dasha River will be monitored during construction in accordance with the EMP monitoring program to identify and confirm results of the impact assessment and effectiveness of adopted mitigation measures.

27. **Air Pollution.** Anticipated sources of air pollution from construction activities include: (i) dust through blasting, excavation, moving equipment, traffic on unsealed roadways, loading and unloading operations, stockpile stacking and land reclamation operations; (ii) vehicle emission from construction vehicles (gaseous CO, CH, and NO_2) and heavy diesel machineries and equipment; and (iii) asphalt flue gas during road pavement. There is no sensitive receptor within 200 m near the proposed location of the asphalt mixing station. After diffusion, the impact from asphalt flue gas resulting from mixing is not significant. A series of mitigation measures are defined in the EMP for reducing the impact of air emission.

28. **Noise.** A significant increase in noise is expected during construction, due to various construction and transportation activities. Construction activities will involve excavators, bulldozers, graders, stabilizers, concrete-mixing, drills, stone-crushing, rollers and other heavy machinery. The trench excavator, roller and compaction machine will generate noise during pipeline construction. However, the noise impacts will be temporary and localized. There are few sensitive receptors near the water and wastewater infrastructure projects but there are scattered residences near the road project. A detailed series of mitigation measures will be implemented to meet the PRC construction site noise limits and to protect sensitive receptors, including regulating hours of construction. Temporary noise protection will be used when necessary. The EMP monitoring plan includes monitoring of noise at sensitive areas at regular intervals and if noise standards are exceeded, equipment and construction conditions shall be checked, and mitigation measures shall be implemented to rectify the situation. The EMP also includes the conduct of monthly interviews with residents living adjacent to construction sites to identify community complaints about noise, and seek suggestions from community members to reduce noise annoyance. Community suggestions will be used to adjust work hours of noise-generating machinery.

29. **Solid Waste**. Sources of solid waste during construction include municipal waste from worker camps and construction solid waste, including debris, sand, stones, broken brick, wood waste, scrap metal, scrap steel etc. The domestic garbage will be collected regularly and delivered to the place designated by the local sanitation agency for proper disposal. The contractor will develop a solid waste transport and disposal plan consulting with the local Housing and Urban-rural Development Bureau or relevant agencies.

30. **Biological Resources**. No area of the project site is within a legally protected site or a site proposed for protection. The project site does not include critical habitats with recognized critically endangered or endangered species. No rare and endangered species were identified and recorded in the project area during the domestic EIA process. The Dasha River is not able to sustain aquatic life of ecological significance or high biodiversity due to its polluted state. Flora to be affected in project area includes mostly shrubs, common seasonal crops, and weeds. The impact on flora is mainly through land use changes. The current land properties are as: cultivated land (8.78 hm^2), and wasteland (46.99 hm^2), flood plain (9.2 hm^2) and woodland (5.6 hm^2). The project will increase vegetation coverage along the proposed road and in the plants. Greening measures will also be taken for the spoil sites. Other protection and mitigation measures specified include proper backfill, compaction and re-vegetation requirements, compensatory planting of an equivalent or larger area of affected trees and vegetation in compliance with the PRC's forestry law, and use of only native plant species of local prevalence for re-vegetation. The EMP specifies that contractors shall identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated roadside areas, trees, inner areas of bridges and river riparian zones etc.

31. **Public utilities and community health and safety.** Traffic may be affected as construction traffic in project area increases, causing temporary inconvenience to traffic, residents, commercial operations, and institutions. Some construction sites will be located close to residential communities, presenting a threat to public health and safety. The construction may also contribute to road accidents through the use of heavy machinery on existing roads. Construction may cause unexpected interruptions in municipal services and utilities because of damage to pipelines for water supply, drainage, and gas supply, as well as to underground power cables and communication cables (including optical fiber cables). Mitigation measures include development of a traffic control and operation plan, survey of underground utilities and other facilities, information disclosure and construction site protection.

32. **Occupational health and safety**. Construction industry is considered to be one of the most hazardous industries. Intensive use of heavy construction machinery, tools, and materials present physical hazards including noise and vibration, dust, handling heavy materials and equipment, falling objects, work on slippery surfaces, fire hazards, chemical hazards such as toxic fumes and vapors etc. Contractors will implement adequate precautions to protect the health and safety of their construction workers. The occupational health and safety risks will be managed by applying measures in the following order of preference: avoiding, controlling, minimizing hazards, and providing adequate protective equipment. The contractors must designate an Environmental Health and Safety Officer and produce an Environmental Health and Safety Management Plan. This plan will outline detailed provisions for clean water, handling of sewage and wastewater, solid waste management, personal protection equipment, emergency preparedness and response, and safety communication. A detailed training program will also be prepared and implemented.

33. **Operation Phase**. The major potential impacts of the infrastructure component for LIP Phase 1 during operation phase include traffic noise, vehicle emissions, noise from pump stations, odor from wastewater treatment plant, accidental failure of WWTP and risk of spills caused by traffic accidents with impacts on rivers and groundwater, occupational health and safety related to the water treatment and wastewater treatment processes and sludge disposal.

34. **Wastewater pretreatment**. Wastewater generated in the LIP industries will be subject to PRC requirements for pretreatment of the wastewater prior to discharge to the wastewater collection system. The PRC has general industrial pretreatment standards as well as sector specific pretreatment standards. Failure of the LIP industries to comply with the relevant pretreatment standards presents a risk to the sewerage network as well as operations of the WWTP. The LMC and Baiyin EPB will monitor and validate the proper operation of LIP industrial pretreatment systems. Monitoring data and compliance assessments will be included in the environmental management information system (EMIS). The need for proper pretreatment is also flagged as loan assurance.

35. **WWTP Odor**. The odor produced in the WWTP is mainly from pre-treatment, such as coarse screen, lift pump room, fine screen, and grit chamber and sludge treatment. The major pollutants of odor are NH_3 and H_2S. The Screen chamber, aerated grit chamber and distribution chamber will be covered. The gases will be delivered to the blower room using draft fan and imported to the G-BAF tanks for biological treatment. The removal rate by G-BAF tanks is estimated as 50%. The emission rates of NH_3 and H_2S are estimated as 0.0757 kg/h and 0.0035 kg/h respectively.

36. **Treated Wastewater Reuse System**. The wastewater treatment plant has been designed to allow for 100% recycling of the treated wastewater effluent, meeting PRC Class 1A wastewater standards. The WWTP is being equipped with a treated effluent storage tank (volume of 3,000 m^3) to allow for management of the wastewater reuse distribution systems, consisting of both piped water reuse distribution as well as tanker trucks. The storage tank will also be used in case of WWTP malfunctioning as emergency storage tank. Such a storage system is necessary to balance the treated water production with the treated water reuse, which are not always matched in time or volume. Although the system will eventually be capable of handling 100% of the treated

wastewater effluent, a discharge pipeline is constructed to the Dasha River in the interim period until 100% reuse can be achieved (by 2019).

37. **WWTP Solid Waste and Sludge**. The solid wastes during operation of WWTP include screenings, grits, sludge and domestic solid wastes generated by the working staff. The LIP has received an agreement from the operator of the new Jingyuan County Landfill No. 2, which is under construction that allows the WWTP sludge to be disposed in the new landfill after dewatering. The design capacity of the new landfill is 820,000 m^3, with an expected life of 10 years (2015-2024). The landfill will be in operation before the WWTP is put in operation, and will be equipped with leachate collection and treatment facilities. If the LIP pretreatment system is successful in maintaining good operations of the industrial pretreatment systems and the LIP WWTP operates properly, the beneficial reuse of the sludge will also be considered in the future. The domestic EIA recommended landfill disposal mainly on the basis of other WWTPs in the PRC and the sludge quality problems in these facilities.

38. The **impact of water extraction on regional water resources** has been assessed through regional water balance analysis in the context of the Yellow River water allocation plan. The results are also summarized in the water resources assessment report. The assessment confirmed that the Yellow River water extraction rate for the project's water treatment plant will remain within the approved extraction quota for Jingyuan County. The proposed supply amount is 60,000 m^3/d for 2020 and 200,000 m^3/d for 2030, with a design abstraction guarantee rate of 97%. The Yellow River has an average annual flow of 920 cubic meters per second (m^3/s) and a historic minimum flow of 236 m^3/s. The amount proposed to be withdrawn will thus not exceed 1 percent of the Yellow River at maximum extraction rate and minimum flow. The water quota is transferred internally from irrigation savings due to the promotion of drip irrigation to replace flood irrigation. There will no additional quota for Jingyuan County. A water quota transfer and usage agreement has been signed between Liuchuan Industrial Park Management Committee, Liuchuan Irrigation Project Management Bureau and Jingyuan County Water Affairs Bureau. The proposed water supply subcomponent will not increase additional water quota of Jingyuan County. This is confirmed in the water resources assessment report approved by the Gansu province water resources authorities.

39. **Sediment Disposal at Primary WTP**. The annual average Yellow River source water sediment concentration is 4 kilograms per cubic meter (kg/m^3); however in summer it reaches ~35 kg/m^3. Common practice for high sediment water is to provide preliminary treatment to settle out the sediment and the preliminary WTP is designed for sedimentation and sand drying beds. The sediment from the preliminary WTP will be transported to the barren mountain adjacent to the WTP. The plant operator will undertake routine monitoring for sediment quality. The area will be protected from public access and routine soil conservation and protection measures taken to ensure that the material does not impact surrounding land. This requirement is flagged as project assurance.

40. **Disinfection Facilities**. At the secondary WTP, the LDI evaluated various treatment process options and selected the following: pre-chlorination, coagulation with poly-aluminum chloride, sedimentation, filtration by V-filter, and clean water tank with chlorine gas disinfection. This is standard process for Yellow River water which typically has high turbidity. According to the LDI the treated water quality will meet the national "Drinking Water Health Standards" GB5749-2006. There is a risk of leakage and spills during transporting, storing and handling. Transport vehicles and personnel should be qualified and trained with hazardous chemical substance transportation. Chlorine leak detector will be equipped in the chlorine storage room and feed room. Emergency showers will be located in the chlorine storage room with breathing devices and other rescue materials. The ventilation system inside the chlorination room and storage room will be designed according to the state regulations. An emergency response plan, as part of the emergency preparation and response plan of the Liuchuan Industrial Park will be developed and implemented.

41. **Noise.** Noise modeling at the two WTPs and the WWTP indicated that the use of noise suppression equipment can keep noise levels to acceptable limits meeting PRC standards at the boundaries of the facilities. As such, there is no need for a protection zone around any of these facilities related to noise impacts. For the Xihuan Road project, traffic noise prediction values for sensitive sites along the road in short, medium and long terms were modeled. According to the prediction results, noise levels are predicted to exceed the standard in medium and long terms, in particular in nighttime. Noise attenuation and protection measures have been defined in the EMP, including: (i) the speed of vehicles will be controlled at 50 km/h in the park; and (ii) noise insulation windows will be installed at sites (84 households) where noise levels are predicted to exceed the PRC standards in the short-term. Total cost for the insulation windows is estimated at CNY373,000, which is included in the contract package of the road (RD-C02).

42. **Induced and cumulative impacts**. The potential concern that the project may induce uncontrolled industrial development within LIP has been addressed through the conduct of a planning EIA for the LIP Phase 1 (23-km^2), which was approved by the Gansu Province EPD in 2012. The planning EIA concludes that the LIP Phase 1 is feasible from an environment point of view, but defines clear requirements to safeguard the environment during LIP development and operation, including: (i) industries introduced to the LIP must comply with national industry development policy, clean production and circular economy, promoting resource use efficiency;[5] (ii) the introduction of high water consuming industries must be strictly controlled; (iii) an EIA including water resources assessment is a pre-requirement for each enterprise planning to enter the park; (iv) each enterprise in the park as well as the LIP as a whole (through the LMC), must avail of emergency preparedness and response plans; and (v) LMC should establish an environmental protection division and develop strict environmental management and supervision procedures and plans. These requirements will be complied with through the establishment of an environment management system (EMS) for the LIP, coordinated by LMC. The EMS subcomponent will work to ensure that environmental management of the LIP is performed to international best practices and obtain LMC ISO14001 certification as well as “eco-industrial park” (EIP) status of LIP under the Ministry of Environment and NDRC programs. The EMS component under the project will have a budget of CNY2.6 million ($430,000), which will provide support for: (i) developing environmental management and early response policies and procedures, targeting ISO 14001 certification of LMC by 2018; (ii) strengthening supervision, monitoring and reporting of environmental activities in the LIP by LMC, including basic equipment, environmental management information system (EMIS), emergency preparedness and response, and training; (iii) developing a road map for national EIP accreditation of LIP by MEP or NDRC by 2025.

E. Information Disclosure, Consultation and Participation

43. In the framework of the environmental due diligence, meaningful consultation was conducted with key stakeholders and potentially affected people. In the first round of consultation, the EIA institute distributed a total of 120 questionnaires to 115 affected persons (APs) from different age groups, gender, educational backgrounds and 5 project affected organizations. Of these, 118 questionnaires were returned (114 APs and 4 organizations) with a return rate of 98.3%.

44. In the second round of consultation, the EIA Institute undertook consultation meetings together with the PPTA Environmental Consultant on 16 January 2014 under the support of LMC to present the main anticipated impacts and proposed mitigation measures as defined in the draft FSR, DEIA and project IEE and collect the public feedback. During the second round, 100% of the APs and stakeholders supported the project. Consulted people believed that the Project will benefit the local economy, the quality of life, the environment, and especially the County’s economic and industrial diversification and transformation. Negative opinions about the Project focused on noise and air pollution associated with project construction, the need to ensure sustainable and reasonable long term development plan of the LIP, and introduction of low

[5] The PRC Government’s 'Circular Economy' initiative is a Sustainable Consumption and Production (SCP) program that strives to meet these challenges through cleaner production, industrial ecology and life-cycle management.

pollution industries to protect the regional environment. The mitigation measures defined in the EMP as well as the proposed EMS address these specific concerns to a certain extent. The due diligence conducted during PPTA as well as the planning EIA for LIP confirmed sustainability of the LIP development Phase 1 (23-km^2) and indicated that Phase 2 (50-km^2) is most likely feasible. However, a review of LIP development plans beyond the 50-km^2 will be required to ensure resource use efficiency and sustainability, also accounting for mid- to long-term climate risks.

45. Information was disclosed to affected people through newspaper and posters within the LIP. This project IEE will be disclosed on ADB's project website. Public consultation conducted during project preparation indicated that potentially affected people had a positive attitude toward the Project.

F. Grievance Redress Mechanism

46. A grievance redress mechanism (GRM) has been defined to deal with public complaints related to project activities during project implementation and operation. The BPMO will establish a Project Public Complaint Unit (PPCU). The PPCU will instruct contractors and construction supervision companies (CSCs) if people complain about the project. The PPCU will coordinate with the county EPB and other government divisions, if necessary, and will be supported by the Loan Implementation Environmental Consultant (LIEC), hired under the Project Implementation Consultant Support (PIC). The PPCU will establish a GRM tracking and documentation system, including procedures to retrieve data for reporting purposes to the BPMO and ADB.

G. Key EMP Implementation Responsibilities

47. The BPMO will have main EMP coordination responsibility. BPMO will appoint an environmental management lead (EML) to coordinate environmental issues associated with each infrastructure component, subcomponent and contract package. The EML will take charge of (i) coordinating the implementation of the EMP and developing implementation details; (ii) supervising the implementation of mitigation measures during project construction and operation; (iii) ensuring that environmental management, monitoring, and mitigation measures are incorporated into bidding documents, construction contracts and operation management plans; (iv) submitting annual EMP monitoring and progress reports to ADB; (v) coordinating the local grievance redress mechanism (GRM); and (vi) responding to any unforeseen adverse impact beyond those mentioned in the DEIA, the project IEE and the EMP. The LIEC will support the EML technically and they will jointly check the overall implementation of environmental management provisions of the EMP.

H. Risks and Assurance

48. Environmental risks, and the assurances required to address these risks, have been identified in the project IEE. The majority of environmental risks relate to design features and operational plans which will avoid or mitigate impacts, but which rely on the implementers' commitment and capacity to implement and consistently follow up. The remainder relate to the likelihood of unexpected negative impacts. The major risks are listed below:

i. Failure of the LIP industries to comply with the industrial wastewater pretreatment standards;
ii. Failure to establish water source protection zone at the Yellow River water extraction point;
iii. Inadequate capacity of the executing agency (through its BPMO) and LMC in environment management, which could result in inefficient project and EMP implementation; and
iv. Inadequate environment, health, and safety procedures in the LIP and inadequate environment management capacities of LMC.

49. Commitments by the executing agency and the LMC will be incorporated into the project agreements as covenants to ensure that the measures are implemented in a timely and complete fashion, including (i) a commitment to complete reuse facilities within LIP Phase 1 by 2019, and 100% re-use of treated effluent from the WWTP for landscape irrigation and industrial processes, and to explore opportunities for beneficial WWTP sludge reuse, (ii) a commitment to establish a source protection zone at the water extraction works of the WTP, and (iii) a commitment to develop an environment management system (EMS) for the LIP including ISO14001 certification of LMC by 2018, and EIP accreditation by 2025 (target).

50. The overriding assurance required is that the executing agency and the local government bodies as appropriate will ensure that the full range of effective measures set out in the project IEE and EMP are undertaken, and guarantees that the environmental management provisions and the environmental monitoring plan will be implemented effectively during project implementation, and that the implementation reports of the environmental management and monitoring plan in accordance with ADB requirements will be submitted in a timely fashion. Part of this monitoring and management commitment will be a commitment to implement and maintain an appropriate GRM. The assurance also will cover re-use of treated wastewater, appropriate treatment and disposal of wastewater sludge.

F. Conclusion

51. The project IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimized to an acceptable level. The project is feasible from an environment safeguards point of view. The public consultation indicated that the majority of the potential APs supported the project and project components and believed they would benefit the local economy, raise residents' living quality, improve local environmental conditions, and effectively protect the local environment. The overall findings of the DEIA and the project IEE are that some negative impacts on air, water, soil and acoustic environment are expected, in both construction and operation phases. Any adverse environmental impacts and risks associated with the project can be prevented, eliminated, or minimized to an acceptable level, if all the mitigation measures and monitoring requirements defined in the EMP are strictly implemented during detailed design, construction and operation, and the environmental management and institutional capacities of BPMO and the operators of project facilities (OPFs) are strengthened through implementation of the comprehensive training and capacity building program. The development and implementation of the LIP environmental management system (EMS) will be a critical aspect to ensure environmentally friendly operations of the project infrastructure and entire industrial park.

LINKED DOCUMENT 11
RESETTLEMENT PLAN

A. Introduction

1. The proposed ADB Financed Gansu Baiyin Integrated Urban Development Project consists of three components including: (i) Liuchuan Industrial Park (LIP) infrastructure development; (ii) Baiyin intelligent traffic management system; and (iii) technical and vocational education and training and institutional capacity building. Component I involves land acquisition, house demolition and resettlement, and components II and III will not cause any resettlement impacts. Component I, Liuchuan Industrial Park Urban Infrastructure Development (the project), consists of three subprojects including: (i) wastewater treatment plant (WWTP) and pipelines; (ii) water supply plant (WSP) and pipelines; and (iii) road construction. The collective land acquisition for WWTP was completed in August 2012. The collective land acquisition for the road construction on the section north of National Highway 109 was completed in November 2013. Therefore, this resettlement plan focuses on land acquisition for road construction in the south section as well as the water supply plant (WSP) and pipelines. Meanwhile a due diligence report on completed resettlement has been prepared as an appendix of this RP.

2. The RP will be finalized based on the final design and detailed measurement survey (DMS) and be submitted to ADB for review and approval prior to commencement of land acquisition and resettlement activities and award of civil work contracts for the water supply plan and pipelines and for the southern section of the road construction.

B. Land Acquisition and Resettlement Impacts

3. In total, the project will occupy 1,158.31 *mu*[1] of state-owned land (including 830.96 *mu* of stated-owned barren hills, 6 *mu* of irrigated land owned by Lantong Farm, and 321.35 *mu* of land acquired already) and acquire 397.74 *mu* of collective-owned land permanently, including 286.87 *mu* of irrigated land, 32.57 *mu* of housing site land and 78.3 *mu* of idle land. The project affected scope includes 4 groups, 2 villages, and 2 townships, affecting 67 rural households, and 337 persons in Jingyuan County due to the land acquisition and house relocation. 8,252.41 m^2 of rural residential houses will be demolished and 35 households and 156 persons in total will be affected, in which land acquisition will also affect 23 HHs and 99 APs. 155 *mu* of land will be occupied temporarily and 46 rural households and 243 persons will be affected. 4 households with 20 persons affected by the project fall into vulnerable groups.

[1] A *mu* is a Chinese unit of measurement (1 *mu* = 666.67 square meters).

Table 1: Summary of LAR Impacts

Subproject	Location	Land Use						HD	Affected Persons							
		Total (mu)	Subtotal (*mu*)	State-owned Occupation (*mu*)			Collective-owned acquisition (*mu*)		LA		HD		Both LA & HD		Subtotal	
				Barren Hills	Farm	Acquired by LIP earlier		m^2	HH	AP	HH	AP	HH	AP	HH	AP
Xihuan Road	Nanshanwei	560.05	360.31	80	0	280.31	199.74	8,052.41	33	127	34	146	22	89	45	184
Pumping Station	Lantong Farm	6	6	0	6	0	0	0	4	23	0	0	0	0	4	23
1st WSP	Xintian	198	0	0	0	0	198	200	18	130	1	10	1	10	18	130
Sludge Landfill Site	Xintian	462	462	462	0	0	0	0	0	0	0	0	0	0	0	0
2nd WSP	LIP	150	150	150	0	0	0	0	0	0	0	0	0	0	0	0
WWTP	LIP	180	180	138.96	0	41.04	0	0	0	0	0	0	0	0	0	0
Total		**1,556.05**	**1,158.31**	**830.96**	**6**	**321.35**	**397.74**	**8,252.41**	**55**	**280**	**35**	**156**	**23**	**99**	**67**	**337**
Main Pipeline (temporary land use)	Xintian	155	0	0	0	0	155	0	46	243	0	0	0	0	46	243

C. Policy Framework and Entitlements

4. The resettlement objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all APs in real terms relative to pre-project levels. The resettlement is in line with not only the Chinese laws and regulations, but also with ADB's policy requirements stated in the Safeguard Policy Statement (2009).

5. Key PRC laws and regulations include: the RP was prepared in compliance with the Law of Land Administration of the People's Republic of China (2004), the Rural Land Contracting Law of the People's Republic of China (implemented from 1 March 2003); Decisions on Deepening the Reform and Strengthening Land Administration issued by the State Council on 21 October 2004; Guidelines Regarding Improving Land Acquisition Compensation and Resettlement System (implemented from 3 November 2004) and other applicable regulations. The RP was also based on local policies regarding land acquisition and resettlement (LAR) in Gansu Province, Baiyin City and Jingyuan County, and ADB's Safeguard Policy Statement (June 2009). According to the above policy frameworks, and in consultation with local governments and affected persons (APs), the resettlement principles of the Project are: (i) Compensation and interest provided to APs should at least maintain the same living level before the project. (ii) Compensation and resettlement should be given to all APs regardless their legal titles or entitlements. (iii) In case per capita cultivated land is not sufficient to maintain APs' livelihood, adequate cash compensation or economic recovery methods should be provided to APs so that similar income could be maintained. (iv) The APs should be fully informed about qualification materials, resettlement and compensation options and standards, living standard and income recovery plans, project implement schedule, and be involved in the implementation of the RP. (v) Land should not be acquired before the APs obtain the replaced land or sufficient compensation. (vi) Both executing agency and the independent third party should monitor the implementation of compensation and RP. (vii) Special support and treatment should be given to members of disadvantaged groups to ensure their living conditions. The APs should be given opportunities to get benefits from the RP. (viii) The RP should be combined with master plans of the county, city and district. (ix) The budgets of compensation and resettlement should be made completely and comprehensively, and the funds should be disbursed timely.

D. Public Participation and Grievance Redress

6. During the project preparation stage, a series of consultation activities (about 13 times) were carried out with the APs, administrative villages (AVs), project resettlement offices (PROs) and other project stakeholders (about 650 person times in total). The APs have participated in the preparation of the RP through the impact measurement and socioeconomic surveys, and village meetings. Their concerns and comments have been integrated into the RP. Further consultations will be held during the detailed design stage and implementation of the RP. A grievance procedure will be established for the APs to redress their LAR issues, including four channels: (i) village resettlement offices (ROs), (ii) township resettlement offices; (iii) Land Division of LIP; (iv) BPMO; and (v) appeal to the external agency.

7. The Resettlement Information Booklet (RIB) was distributed to the APs and affected groups in June 2014, and the first draft of this RP was disclosed on ADB's website in June 2014.

E. Compensation Rates for LA and HD

8. Compensation rates for LA include CNY38,713.5/*mu* for irrigated land, and CNY19,356.75/*mu* for housing site and idle land. Young crop compensation rate is CNY1,759.7/*mu*. The rate of temporary land use in one year is CNY3,520/*mu*.

9. The market assessment based on replacement costs will determine the final

compensation rates for demolished houses in the project area. An independent appraisal company (Jingyuan Lucheng Housing Appraisal Services Company) has been engaged to conduct this assessment. The guidance prices of HD compensation include CNY600~1,300/m^2 for brick-concrete houses, CNY400~1,200/m^2 for brick-wood houses, and CNY300~800/m^2 for earth-wood houses. Additionally, moving subsidy to relocated HHs will be provided at the standard of CNY200 per capita; transition subsidy will be provided at CNY80 per capita per month for actual months of the transition period. Every HH will be granted with bonus of CNY20,000 after the agreement of HD is signed and the structures are demolished before the deadline published by the local government.

10. Other attachments and auxiliary structures will also be compensated in line with their replacement value.

F. Resettlement and Livelihood Restoration

11. To minimize the resettlement impacts to the APs and restore their living standards, detailed programs of restoration and resettlement have been arranged in the RP. Based on the socioeconomic survey and analysis of the affected households, and local experiences in relocation and resettlement of similar projects, measures for resettlement and income restoration have been prepared.

12. The income rehabilitation measures for land affected farmers include cash compensation, land replacement, land circulation [2], pension insurance, and employment creation by existing or new enterprises in the LIP, skill training for the APs, employment related to the Project, and non-monetary support and so on.

13. The resettlement measures for house affected farmers include unified resettlement houses or self-built new houses. If APs prefer the resettlement houses, they will be relocated in the resettlement living area south of LIP, which will be completed in December 2014 with floor areas of 173.2 m^2 of a two-story house. According to the survey, 34 HHs (out of 35 HHs) affected by house demolition are willing to choose these resettlement houses. 1 household plans to purchase land in the same village group and build their new home on the land.

14. During house demolition and relocation in the resettlement living area, AHs need to “pay or retain the difference” between the actual appraisal value of the old houses and the physical cost of the new resettlement houses; the original housing plot will be compensated with the rate of LA (CNY19,356.75/*mu*); the new housing plot will be serviced and provided to the AHs for free.

G. Institutional Arrangement

15. The Baiyin Municipal Government (BMG) will be the executing agency (EA) for Gansu Baiyin Integrated Urban Development Project. Liuchuan Industrial Park Management Committee (LMC) will be the implementing agency for the LIP Infrastructure Development Component. The Baiyin ADB Project Management Office (BPMO) will assume the overall responsibility for the management and monitoring of the LAR, including the compilation and implementation of the RP, the planning of the LAR, internal monitoring and engagement of external monitoring. The LMC will take the primary implementation responsibility for the resettlement quantity confirmation, consultation, financing and timely delivery of entitlements with the support from relevant local government bureaus. The township resettlement offices and village resettlement offices will actively participate in the implementation of this RP. Although some officials were experienced based on the Phase I ADB project, to ensure smooth implementation, the staff in charge of the LAR will undertake further training on resettlement implementation organized by the BPMO. A

2 Rural land circulation is the transfer of the right to operate and manage the land. The ownership of the land remains the same.

training program is included in the RP for building the capacities of resettlement personnel at various levels.

H. Resettlement Budget and Implementation Schedule

16. All costs incurred during LA and resettlement will be included in the general budget of the Project. Based on prices of March 2014, the resettlement costs of the Project are CNY96,539,907 (about 7.7% of the total project cost of CNY1.25 billion), including basic LA and HD costs of CNY63,786,522.9 or 66.07% of total costs; taxes and fees (include resettlement planning and monitoring costs, resettlement management costs, and resettlement institute training costs and supporting fund for vulnerable groups) on LA and HD of CNY23,977,028.9 or 24.84% of total costs; and contingencies of CNY8,776, 355.2 or 9.09% of total costs.

17. The construction of WWTP (LA completed in 2012) commenced in June 2014 and will be complete in December 2017, WSP will commence in September 2015 and complete in November 2019, and Xihuan Road will commence in April 2016 and complete in September 2018. The resettlement implementation schedule has been prepared based on the preparation and construction timetable. The LA, HD, compensation and resettlement work of WSP will start in March 2015 and get ready for construction in June 2015. The LA, HD, compensation and resettlement work of Xihuan Road will start in October 2015 and get ready for construction in January 2016. The Project will complete all the resettlement activities and deliver all the entitlements by December 2017. The resettlement houses are under construction at present and will be completed in December 2014.

I. Monitoring and Evaluation

18. A detailed plan for both the internal and external monitoring and evaluation (M&E) is included in the RP. The BPMO will submit an internal monitoring report semi-annually to ADB. Furthermore, the BPMO will employ an external resettlement monitoring agency as the independent external monitor to deliver external monitoring reports. A thorough baseline study will be completed before the LAR begins. The first monitoring report will be submitted in August 2014. After that and till the LA and HD completion, semi-annual monitoring reports will be prepared and submitted for ADB's review. Annual monitoring reports will be prepared and submitted for ADB's review for two years after LA and HD activities completion. BPMO will submit a project resettlement completion report will be submitted by BPMO to ADB after the income rehabilitation and livelihood restoration of the affected farmers are successfully achieved.

LINKED DOCUMENT 12
RISK ASSESSMENT AND RISK MANAGEMENT PLAN

Risk Description	Risk Assessment	Mitigation Measures or Risk Mitigation Plan
1. Public Financial Management		
1.1 Counterpart funding		
Late appropriation of a domestic bank loan may delay project implementation.	Medium	BMG caused JCG and LMC to agree with their local bank to issue the commitment letters of the loan for counterpart funds. The domestic bank loan will not be allocated for resettlement and land acquisition costs to avoid any startup delay of the project. BMG and the PMC will conduct public financial management training and workshops to strengthen the creditworthiness of JCG to enable them to find alternative financing options.
1.2 Monitoring		
Public financial management need to be improved because all four implementing agencies are inexperienced to handle loans from an international financial institute including ADB, and an internal audit mechanism is not officially in place in the four implementing agencies.	Low	PMC includes 10 person-months (2 person-months per year) of financial specialist to provide detailed guidance on financial management for a project account established under each implementing agency. PMC will provide capacity-building support to strengthen the capacity of the implementing agencies' internal auditing systems.
2. Procurement		
2.1 Capacity		
Four implementing agencies lack experience in civil works and in goods procurement in ADB-funded projects.	Medium	A start–up consultant and the PMC will have a procurement specialist to provide continuous assistance to the four implementing agencies. BMG engages an experienced tendering company as early as June 2014 to provide hands-on training to staff of the four implementing agencies. Four implementing agencies ensure to engage experienced engineering design institutes to prepare technical specification of bidding documents. PMC will provide training on ADB procurement procedures through the loan capacity-building component.
2.2 Procurement		
Procurement could be delayed due to poor preparation of bidding documents and/or an overlong approval process.	Medium	BMG will ensure that the four implementing agencies use standard PRC and ADB bidding documents. BMG and the four implementing agencies will engage experienced engineering design institutes. PMC will provide training on ADB procurement procedures through the loan capacity-building component.
2.3 Bidding document		
Contract variations could occur frequently during project implementation if detailed designs and bills of quantities have been poorly prepared.	Low	Four implementing agencies will engage experienced design institutes for preliminary engineering designs and detailed engineering designs of the subprojects. BMG will engage subproject-specific consultant teams (e.g. TVET consultant team and EMS consultant team) to draft good quality bidding documents. BMG will engage (i) a procurement specialist as a start–up consultant for 6 person-months, and (ii) a contract management and procurement engineer as a deputy team leader of the PMC for a total of 40 person-months for bid document review.
3. Governance and Corruption Risks		

Risk Description	Risk Assessment	Mitigation Measures or Risk Mitigation Plan
3.1 Corrupt practices		
Political interference, conflicts of interest, and nepotism could affect project design, procurement, and implementation, leading to poor-quality subprojects.	Low	BMG provides assurances to undertake anticorruption actions: (i) involve full-time officials from the government discipline investigation bureau in the bidding process, awarding of contracts; (ii) include pertinent clauses on anticorruption in the bidding documents and contracts; and (iii) check performance and remind implementing agencies during day-to-day operations and communications of loan covenants against corruption.
4. Others		
4.1 Official and staff continuity		
Changes in key personnel within the BMG and the four implementing agencies could affect progress and continuity in project implementation.	Low	ADB will hold regular consultations and dialogue with officials from the PRC government, BMG, and the four implementing agencies, as well as the local beneficiaries to ensure their continuous support for the project. BMG and the four implementing agencies will keep detailed project records to maintain good institutional documentation.
4.2 Project cost overrun		
Inadequate detailed engineering design and CNY appreciation against USD may result in project cost overrun	Medium	BMG will monitor quality of bidding documents and project cost through the PMC. BPMO will provide clear instruction on bidding procedures, compliance with instructions, and evaluation and selection criteria. Detailed project cost review and assessment will be conducted during a loan midterm review stage.
4.3 Land acquisition and resettlement		
Delays in approval and implementation of land acquisition could put implementation behind schedule.	Medium	ADB and the BMG will monitor the LMC to ensure that compensation funds are provided to the affected persons and that land is made available to contractors at an early stage of project implementation. BMG will appropriate counterpart funds on time to pay for the land acquisition and resettlement costs.
4.4 Domestically funded project		
Delays in completion of the project funded by JCG and LMC could affect project implementation progress.	Low	BMG cause JCG and LMC to coordinate with appropriate government agencies to implement and complete the domestically funded project on-time.
4.5 Operation and maintenance of project facilities		
Operation and management of the infrastructure created by the project is not sustainable due to lack of capacity or budget.	Medium	A separate consultant team and ADB experts provide support for engaging a private operator for project financed water and wastewater facilities. BMG will ensure sustainability of project facilities by organizing training and study tours under PMC's support. BMG, JCG, BPT assured adequate human and financial resources for operation and maintenance of the project facilities.
Overall	**Low to Medium**	

ADB = Asian Development Bank, BPT = Baiyin public transportation company limited, BMG = Baiyin municipal government, BPMO = Baiyin project management office, EMS = environment management system, JCG = Jingyuan county government, LMC = Liuchuan Industrial Park Management Committee, PMC = project management consulting service, TVET = technical and vocational education and training.
Source: TA Consultants

LINKED DOCUMENT 13
INDUSTRIAL SECTOR ANALYSIS

Executive Summary

1. In the People's Republic of China (PRC), regional economic development is stimulated jointly by natural resource endowments and the region's comparative advantages as much as by supportive regional level economic policies that direct resource and industrial center allocations.

2. The opening up of the PRC was very advantageous for the Eastern Region and its coastal corridors. However, this has resulted in disparities with other regions in terms of foreign direct investments and capital inflows.

3. With the objective of helping other regions catch up, the government promulgated the Western Region Development Strategy (WDS) in 1999. It has been more than a decade since this strategy was implemented. Looking back, under the WDS, the Western Region received strong support from the central government. Five years from its implementation, the region's GDP growth rate along with other economic indicators exceeded that of the Eastern Region allowing for a narrowing gap between the Eastern China's and Western China's economy.

4. Internally, there has been uneven development across cities and counties within the Western Region with provinces like Gansu lagging behind. Baiyin Municipality in Gansu Province is considered a resource-exhausted city. The Municipality has been suffering from industrial decline. Unemployment and livelihood insecurity are considered socioeconomic problems. Since the 11th Five Year Plan (11 FYP), Baiyin Municipality has committed to an economic and social transformation promising renewed industrial dynamism, more jobs, and a reduced sole dependence on natural resources, instead using its inherent resources to transition towards a more diverse economy. The strategy is to now fully develop Liuchuan Industrial Park (LIP).

5. LIP, a key industrial park in Baiyin Municipality, was identified to play a critical role in this transformation. The aim of this section is to explore the industrial development direction in terms of priority industries, and the industrial land development structure, identifying key concepts or projects that will support industrial development. In parallel, macroeconomic trends, policies, benchmarks that will form the industrial base for Baiyin Municipality's transformation and conditions for the development of LIP will be assessed.

6. Through initial field surveys, interviews, and literature analysis, it is observed that the park is at an advantage in terms of location, available market, accessible traffic, flexibility for expansion (50 square kilometers of developable land), and availability of energy and water resources suitable for large-scale high power consumption industrial projects.

7. **Observed Industrial Potential of Baiyin Municipality.** The development of LIP will be significant in terms of its having priority – infrastructure wise, marketing wise, and positioning wise. Industrial development is expected to be the main driver of Baiyin Municipality's economic growth that will create new jobs and draw from the surplus labor available from the surrounding counties. A number of potential industries and directions considered include:

   (i) The existing rare earth industry, non-ferrous metal industry and related downstream/upstream industries as a strong industrial base;

   (ii) Taking advantage of the local coal resource, pursue the development of new coal-based chemical industry for the production of energy and chemical related industries;

(iii) Encouraging industrial transfer of the wide spectrum of equipment manufacturing industries from the Eastern Region and within the province;

(iv) Developing the building materials industry from the availability of clay and non-ferrous metal industry resources;

(v) Allotting the development of supporting warehousing and logistics facilities to strengthen distribution;

(vi) Providing the necessary utilities production – through a combination of traditional and renewable resources; and,

(vii) Setting the stage for the development of the service industry to support industrialization and urbanization jointly.

8. To support the Master Plan, an industrial demand analysis guided by priority industries along with the expected estimated population of approximately 34,000 persons by 2020 and 68,000 persons by 2030 follows in the subsequent sections.

9. **Industrial Sector Analysis.** In order to arrive at the priority industries, a policy and industry sector analysis is prepared. This is followed by a demand analysis that will verify total employment, industrial land demand and population for LIP. The entire process is outlined below:

(i) Contextual analysis of Gansu Province as part of Western China;

(ii) A positioning exercise of Baiyin Municipality and LIP;

(iii) Broad Industry Sector Analysis from an economic perspective – value of output and volume of output;

(iv) Short-listing of LIP Industries;

(v) Demand analysis of the industry sector, researching on the potential market size of each of the identified priority industries and the required industrial land;

(vi) Feedback from current LIP industry locators; and,

(vii) Case study analysis and benchmarking.

Macroeconomic and Contextual Analysis of Gansu Province of Western China

1. A number of policies influence Gansu's positioning as part of the Western Region. Under the 'Balanced Development' – earliest regional development strategy, national investment tended to favor the Central and Western Regions. There was a concentration of large and medium infrastructure projects in both these regions from 1953 to 1980, representing 58% of all investment projects during this period. A large portion of heavy industries and military industries were deployed favoring the Western Region over the Eastern Region.

2. During the following period, the opening up policy and coordinated development strategy of the 1990s on the other hand greatly favored the Eastern Region allowing for easier inflow of foreign capital via the coastal regions. During this period the Western Region lagged behind the Eastern Region.

3. In 1999, the Chinese Government implemented the WDS to expedite the Western Region's development. This was supported by a number of policy measures:

- Fiscal transfers to the Western Region increased from ~30% to ~40%. This was accompanied by preferential tax policies and tax exemptions. Domestic and foreign enterprises were given tax breaks for imports focused on infrastructure development. There was increased rural credit provided to the Western Region to encourage domestic investment.

- From 1999 to 2010, national investment projects focused on the Western Region received a total of 143 infrastructure, construction, ecological environmental protection, rural development, education, medical treatment, and public health projects. The proportion of State funding going to the Western Region increased from 26% to 41%.

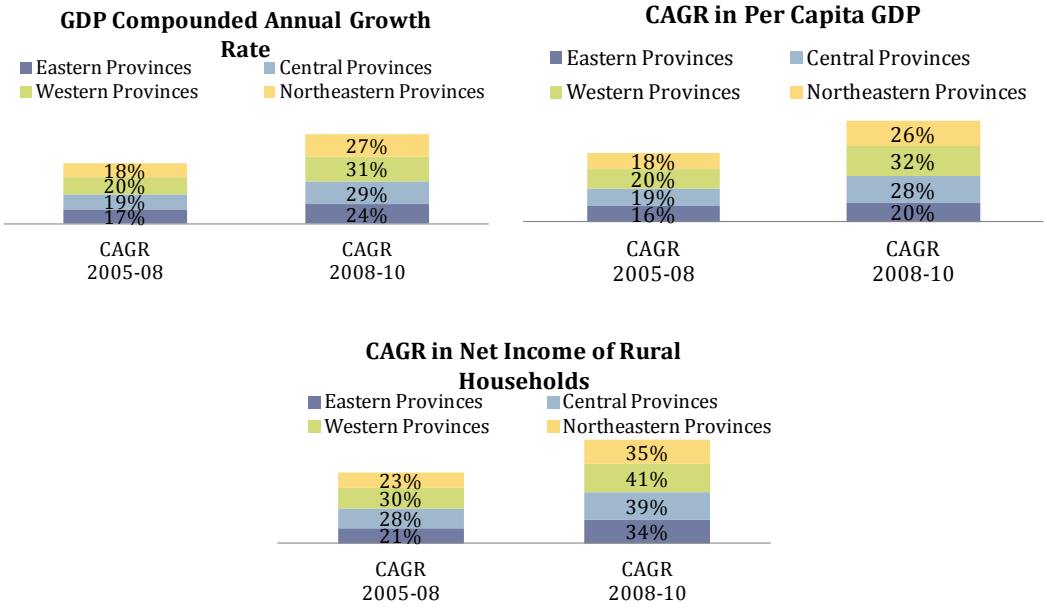
- There was strong financial and credit support from financial institutions including national policy banks, foreign banks, and private capital allowing the Western Region to increase its overall loan scale.

- Several other policy measures were adapted including guidance policies employed for the investment of foreign and private capital, incentive mechanisms to encourage high-level talents to migrate to the Western Region, augmented loan arrangements from financial institutions, and aid support coming from the Eastern Region to the Western Region.

- Pairing policies among regions, including mutual aid relationships between different regions' industrial strengths were adapted to address various aspects of economic and social development. In particular the 'East-West Interaction Policy' promoted cross regional production flows between the Eastern and Western Regions.

4. 2000 to 2010 was a significant 10 year period for the western economy, allowing it to experience accelerated growth beyond that of Central and Northeastern China. The Western Region experienced about 10% growth in GDP, increased GDP per capita and a huge increase in the net income of rural households. The diagrams below show the economic improvements between two periods.

Figure 1: Comparable Compound annual growth rate (CAGR) in GDP, GDP per Capita and Net Income of Rural Households among Regions



Source: China Statistical Yearbook

5. Further study supports that rapid development experienced by the Western Region was enhanced by industrial growth particularly in traditional resource industries like mining. In manufacturing industries, the share of industry value-added soared from 14% to 21% in 10 years.

6. The infusion of infrastructure investments to the Western Region encouraged industrialization and the extraction and use of natural resources. This made the Western Region an increasingly attractive option for the transfer of certain industries from the Eastern Region:

- State Government's increased infrastructure investments to the Western Region since 2000 has supported real estate construction and more service oriented industries. This helped generate additional sources of livelihood.
- The transfer of industries from the Eastern Region accelerated development.
- As an economic development strategy, resource transformation was encouraged, allowing for the harvesting of more than 65% of the country's coal, natural gas, wind and solar and hydropower reserves wherever they were available in the region.
- With the Eastern Region facing rising production costs, resource and environmental constraints, the Western Region was positioned as an alternative area, particularly for industries entering a phase of structural adjustment or those upgrading, expanding or looking to transfer outwards.
- Below is a comparison of average wages between Eastern and Western China's provinces suggesting the competitive advantage of provinces in Western China if wages were considered.

Table 1: 部分省市 2011 年平均工资一览 Selected Provinces' Average Wage (2011)

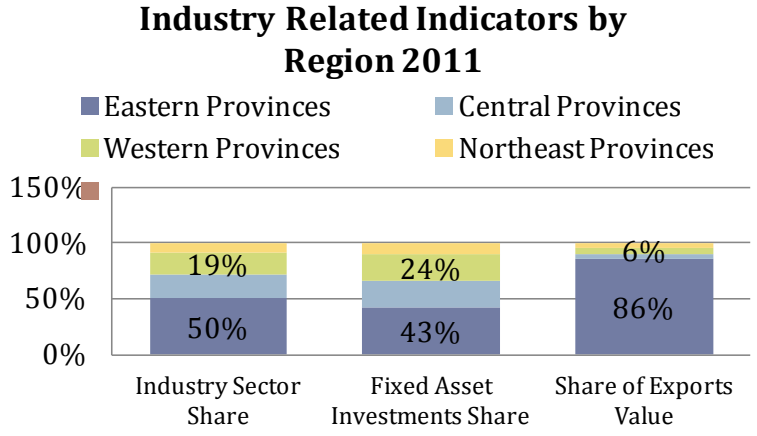
	省份 Province	月平均工资 Monthly Average Wage (CNY)	年平均工资 Annual Average Wage (CNY)	增幅 Growth (%)
	中国东部 Eastern China			
1	北京 Beijing	4,672	56,061	11.2
2	上海 Shanghai	4,331	51,968	11.1
3	浙江 Zhejiang	3,888	46,660	12.4
4	江苏 Jiangsu	3,832	45,987	13.5
5	广东 Guangdong	3,763	45,152	6.3
6	天津 Tianjin	3,520	42,240	12.5
7	安徽 Anhui	3,387	40,640	11.9
8	福建 Fujian	3,249	38,989	19.4
9	山东 Shandong	3,061	36,737	8.9
10	海南 Hainan	3,060	36,716	18.3
11	河北 Hebei	3,014	36,166	6.3
12	湖南 Hunan	2,960	35,520	16.5
13	吉林 Jilin	2,850	34,197	16.3
14	山西 Shanxi	3,325	39,903	13.0
	平均 Average		**41,924**	**12.7**
	中国西部 Western China			
1	宁夏 Ningxia	3,715	44,574	13.9
2	青海 Qinghai	3,541	42,493	14.6
3	重庆 Chongqing	3,337	40,042	7.6
4	新疆 Xinjiang	3,264	39,170	16.5

5	陕西 Shaanxi	3,254	39,043	7.7
6	四川 Sichuan	3,160	37,924	14.5
7	云南 Yunnan	2,949	35,387	17.0
8	广西 Guangxi	2,848	34,178	1.5
9	江西 Jiangxi	2,838	34,055	17.1
10	甘肃 Gansu	2,742	32,906	10.6
	平均 Average		**37,977**	**12.1**
	2012 National Average Annual Wage (CNY)			42,452
	Annual Wage Difference between Eastern and Western China			10%
	Annual Wage Difference between Eastern China and Gansu			27%
	Annual Wage Difference between whole of China and Gansu			29%

Source: http://news.sohu.com/20120706/n347443425.shtml, http://www.xjtj.gov.cn/stats_info/tjfx/13820113728181_3.html

- The Western Region's large potential market, rich energy and mineral resources, and low labor costs all supported industrialization. And this advantage is still evident to this day.

7. Despite the Western Region's industrialization and notable advantages, it still lags behind in terms of foreign trade, domestic capital and inflows and foreign direct investments (FDIs) which form the main backbone of the PRC's economic growth. The diagram below shows Western China lagging behind in terms of per capita disposable incomes and industry sector share, fixed asset investments and exports.



8. There are also internal imbalances among Western China's provinces and also rural-urban disparities which are not uncommon in many provinces around Asia. Gansu Province is at the bottom of the list with lowest per capita disposable incomes. The table below supports this.

Table 2: 城镇居民 2012 年人均可支配收入排行榜 Urban Residents' Disposable Income Per Capita (2012)

排位 Rank	地区 Area	人均可支配收入 Per Capita Disposable Income (CNY)
	中国东部 Eastern China	
1	上海 Shanghai	40,188
2	北京 Beijing	36,469
3	浙江 Zhejiang	34,550
4	广东 Guangdong	30,227
5	江苏 Jiangsu	29,677

6	天津 Tianjin	29,626
7	福建 Fujian	28,055
8	山东 Shandong	25,755
10	湖南 Hunan	21,319
11	安徽 Anhui	21,024
12	海南 Hainan	20,918
13	湖北 Hubei	20,840
14	河北 Hebei	20,543
15	河南 Henan	20,443
16	山西 Shanxi	20,412
17	吉林 Jilin	20,208
	平均 Average	**26,087**
	中国西部 Western China	
1	内蒙古 Inner Mongolia	23,150
2	重庆 Chongqing	22,968
3	广西 Guangxi	21,243
4	云南 Yunnan	21,075
5	陕西 Shaanxi	20,734
6	四川 Sichuan	20,307
7	江西 Jiangxi	19,860
8	宁夏 Ningxia	19,831
9	贵州 Guizhou	18,701
10	西藏 Tibet	18,028
11	新疆 Xinjiang	17,921
12	青海 Qinghai	17,566
13	甘肃 Gansu	17,157
	平均 Average	**19,888**
2012 National Average Annual Disposable Income (CNY)		24,565
Annual Disposable Income Difference between Eastern and Western China		31%
Annual Disposable Income Difference between Eastern China and Gansu		52%
Annual Disposable Income Difference between whole of China and Gansu		43%

Source: http://www.huaxia.com/jxtf/jrsc/xwsc/2013/11/3611929.html, http://district.ce.cn/zg/201301/25/t20130125_24061982.shtml

9. A number of other pressing issues remain to this day including Western China's lack of available capital, the inability to attract and retain human capital and lagging technological infrastructure. The first issue reveals that the Western Region continues to receive capital from national policy assignments and from loans. Internally there are serious capital outflows seen across a number of provinces and very low deposits to loans ratio of 50% particularly for Gansu and its neighboring provinces, Tibet, Xinjiang and Shaanxi.

10. The second issue suggests that despite education focused policies urging future workers to move to the West there remains a huge human capital shortage and brain drain. Low income levels, and poor living and working environments in poorer municipalities could not compare to what many cities (primary, secondary, and tertiary cities) have to offer.

11. Thirdly, Western China's technological infrastructure and services are also behind. This can be observed in the mismatch between GDP structure and employment opportunities. For example, even with a higher share of secondary sector jobs and opportunities the majority of the remaining labor force is largely primary sector workers. There is a lack of secondary and tertiary workers within municipalities in Western China because there are also much fewer opportunities.

12. This suggests that infrastructure investments made in Western China have not been strategic or attractive. Creating more jobs but not creating the environment has not allowed the

region to prosper even with the availability of industry and service sector jobs. There remains an undersupply of workers in the secondary and tertiary sectors willing to live and work in the Western Region compared with other regions. A complete transformation on a municipality to city level is required for both economic and social reasons.

Sub-Regional Development of Lanzhou-Xining Zone as Pilot Area for PRCs first 'Green Economic Zone'

13. There have been a number of attempts to improve Western China's economy. Among these is the delineation of sub-regional areas.

14. **The Lanzhou-Xining-Golmud or Lanxige sub-region has been identified as a pilot practice zone for the green development of the Western Region's resource-based cities.** The 12th Five-Year Plan (12 FYP) imposed increased large-scale investment on industrial projects located within the Western Region to enhance the region's endogenous economic growth. One of eleven designated key economic zones in the Western Region is the Lanxige or 'Lanzhou-Xining-Golmud' economic zone – marketed to be the first 'Green Economic Zone'. Baiyin Municipality is located within this economic zone. The policy focus for the zone is that of a circular economy; making use of regional energy and mineral resource advantages while taking into account ecological sensitivity or the re-use of waste material of one industry as energy for another.

	西北地区重点经济区
兰西格地区	全国重要的新能源、盐化工、石化、有色金属和农畜产品加工产业基地，区域性新材料和生物医药产业基地

	Key Economic Base & Focus
Lanxige Area: Lanzhou-Xining-Geermu	Develop national level new energy, salt, chemicals, non-ferrous metal and animal agricultural industries and regional base of new material and bio-medical industries

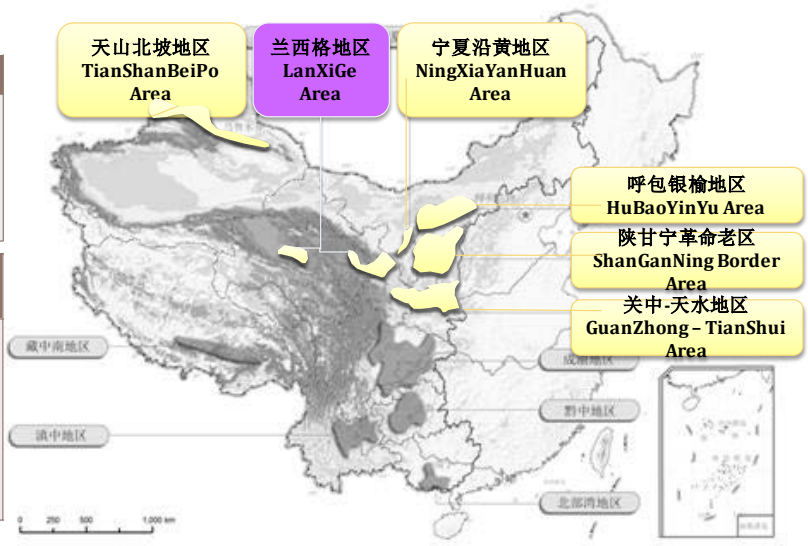


Figure 2: Key economic zones for Western Region development during 12 FYP

Gansu Province's comparative advantages and disadvantages

15. Gansu Province, where Baiyin Municipality is located, can be positioned to exploit its unique advantages. Gansu Province's locational advantage is that it is at the junction of the PRC's Central and Eastern Regions. The Province lies in the Northwest with direct linkages with the east and potential linkages with the south. Connecting Qinghai, Xinjiang, Tibet and other border provinces, Gansu may be considered as PRC's frontier to Eastern Europe and Central Asia. Gansu Province can position itself as a region that is opening itself outward – regionally, inter-regionally (multi-ethnic regions) and to other countries in Eastern Europe and Central Asia.

- 中国东中部地区和西北地区结合部
- At junction of China's Central and Western Regions
- 联通青海、新疆、西藏等边疆省份
- Connecting Qinghai, Xinjiang, Tibet and other minority provinces
- 中国对东欧、中亚开放的前沿阵地
- China's frontier to Eastern Europe and Central Asia

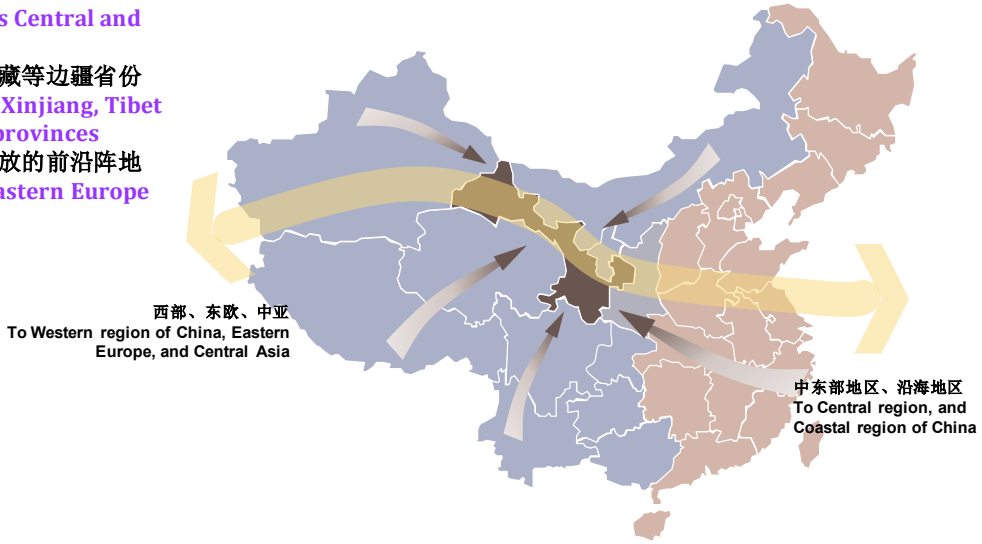


Figure 3: Gansu Province Geographical Positioning

16. Gansu has potential advantages in terms of production output, labor cost/wages and industrial and technological strength. However, it also has some notable disadvantages in terms of resource depletion and its ecological environment. The figure below summarizes Gansu's advantages and disadvantages.

Poor Resource Condition

Gansu is at a relative disadvantage in resource endowment.

Resources	Ranking in Western Region
Oil	3
Gas	7
Coal	7
Iron	5
Manganese	9
Copper	3
Lead	3
Zinc	3
Pyrite	10

Production Advantage

Resources	Of NW China
Integrated Circuits	100.0%
Washing Machine	100.0%
Sulfuric Acid	48.7%
Ethylene	40.0%
Crude Steel	31.0%
Hydropower	29.5%
Cigarettes	28.7%
Pig Iron	27.5%
Rolled Steel	27.3%
Beer	27.0%
Plate Glass	23.4%
Electricity	22.7%
Primary Plastic	21.4%
Metal Cutting Machine Tools	13.4%
Soda Ash	9.6%
Fertilizer	9.5%
Caustic Soda	9.0%

Low Labor Cost

Gansu is suitable for labor-intensive industries

Provinces	Annual Ave. Salary（CNY）
Xizhang	54,380
Ningxia	44,574
Qinghai	42,240
Inner Mongolia	41,484
Chongqing	40,042
Yunnan	35,387
Xinjiang	38,820
Sichuan	37,924
Shanxi	39,043
Guangxi	34,178
Guizhou	33,708
Gansu	32,906

Prominent Industrial and Technological Strength

Established industrial system

- Formed a characteristic industrial system, including Petrochemical, metallurgy, new materials

Strong research capacity

- National key laboratories, such as fine petrochemical research laboratories
- Certain technical advantages in such fields as new materials, bio-medicine, mechatronics, electronics and information, environmental technology, etc.

Fragile Ecological Environment

Severe ecological environmental problems

- Severe desertification, environmental pollution problem and frequent sandstorms
- Located in the upper stream of the Yellow River affecting the ecological security of the entire downstream region.

Figure 4: Gansu Province's Advantages and Disadvantages

(i) **In comparison with the Central and Western China's provinces, Gansu is at a relative disadvantage in resource endowment.** In a current comparison of the mineral resources and energy resources reserves in the various northwestern provinces, Gansu Province is only in the middle or lower level in all resources reserves; its copper, lead and zinc reserves are relatively abundant. However, they are not of absolute advantages.

(ii) The province has potential advantage in terms of volume of production for integrated circuits, washing machines, and chemicals. Gansu is the 4th largest producer of integrated circuits following Shanghai, Heilongjiang and Guangdong.

(iii) The province also has a strong advantage in terms of value of production of non-ferrous metals, rare earth/non-mineral products, electrical equipment and machinery, the production of electric power and heat, as well as agricultural/sideline and beverage production.

(iv) As for the comparative cost of labor, average monthly wages fell behind other provinces in 2011 and 2013 giving the Western Region an advantage in attracting the traditional industry transfers from the Eastern Region.

(v) As the key construction area during the "First-Five Year Plan" and "Third Front Construction" period, Gansu Province has formed a characteristic industrial system and certain scientific research advantages. It has a unique positioning in terms of having industrial systems – particularly in petrochemicals and downstream industries, new materials and metallurgical research with supporting laboratories. Gansu has comparative advantage in terms of industry and technology. Gansu Province has a number of national key laboratories, for example, fine petrochemical research laboratories as well as a number of research institutions including, the Chinese Academy of Science (CAS) Lanzhou Branch, Lanzhou University and other strong research institutions. Gansu also has technical advantages in the fields of new materials, bio-medicine, mechatronics, electronics and information, environmental technology, etc.

(vi) Gansu Province is in the upper stream of the Yellow River, whose ecological security matters to the entire region in the downstream, and it is of national significance.

(vii) However, Gansu is constrained by its high level of potential ecological damage from industrial pollution flowing downstream from other provinces in the Western Region.

(viii) Given the severe ecological environmental problems, coordinated economic and ecological development and strong environmental management is particularly important. The eco-environmental conditions in Gansu are especially harsh with severe desertification, environmental pollution and frequent sandstorms.

17. Gansu Province has a relatively weak economic structure, and it is appropriate to concentrate its limited manpower, material and financial resources for the development of key focus areas. Gansu Province proposed a regional policy of "the center drives two wings". Lanbai economic zone, where Baiyin Municipality is located, is the core area of Gansu Province's key construction area. Gansu provincial government proposed to take Lanbai Economic Zone, consisting of Lanzhou Municipality and Baiyin Municipality, as the core of the provincial construction area to play a central leading role in the province, and even the whole northwest region. It will enlarge and strengthen such dominant industries as petrochemical, non-ferrous metallurgy, equipment manufacturing, new materials, bio-pharmaceuticals, etc., and construct a transport hub and logistics center in the Northwest.

1. 兰白核心区 **Lanbai Core Economic Zone**
2. 酒嘉地区 **Jiujia Area**
3. 张掖地区 **Zhangye Area**
4. 金武地区 **Jinwu Area**
5. 定西地区 **Dingxi Area**
6. 平庆地区 **Pingqing Area**
7. 天水地区 **Tianshui Area**

分布区 **Area**	优势 **Strength**	重点发展产业方向 **Key Industrial Development Direction**
兰白核心区 Lanbai Core	地处中心区位、基础设施完备、产业基础较强、科技人才集中 Centrally located with complete infrastructure to develop industry and to attract hi-tech workers.	做大做强石油化工、有色冶金、装备制造等主导产业，培育发展石化下游产品、有色冶金新材料、动力电池及电池材料、生物医药等新兴产业 Full-speed development of lead industries: petro chemical, non-ferrous metallurgy and equipment manufacturing., Cultivate emerging industries such as petro chemical downstream products, non-ferrous metallurgy new materials, power battery and material, bio medical and etc.

Figure 5: "The center drives two wings" development pattern in Gansu Province

18. **Lanbai Economic Zone plays an important strategic role in Gansu Province's economic layout.** In 2012, the population of Baiyin and Lanzhou Municipalities accounted for 21% of the province's total; their combined GDP accounted for 35%. Gansu Province's regional development strategy has also given high priority to the development of Lanbai economic zone. The development of both municipalities will receive great support from the provincial government financially and in key large industrial project deployment.

19. **The development of Baiyin Municipality will be a matter of success or failure for Lanbai Economic Zone's construction and the implementation of 'the center leading' regional policy.** Lanzhou – Baiyin Economic Zone's Development Planning (2011) proposed that *Baiyin Municipality would be constructed to be the industrial development center of Lanzhou Economic Zone.* Baiyin industrial concentration district, together with the main urban area and new urban area of Lanzhou will constitute a joint central core in the economic zone. *LIP has been designated as the key industrial park* in Gansu Province's layout for large scale industrial projects.

20. **Existing Industrial Developments in Lanzhou and Baiyin.** Lanbai Core Economic Zone, which comprises of Lanzhou and Baiyin, is a critical industrial development zone in Gansu Province. Three major industrial clusters in Lanbai Core Economic Zone are Lanzhou New District, Lanzhou main urban area and Baiyin urban area.

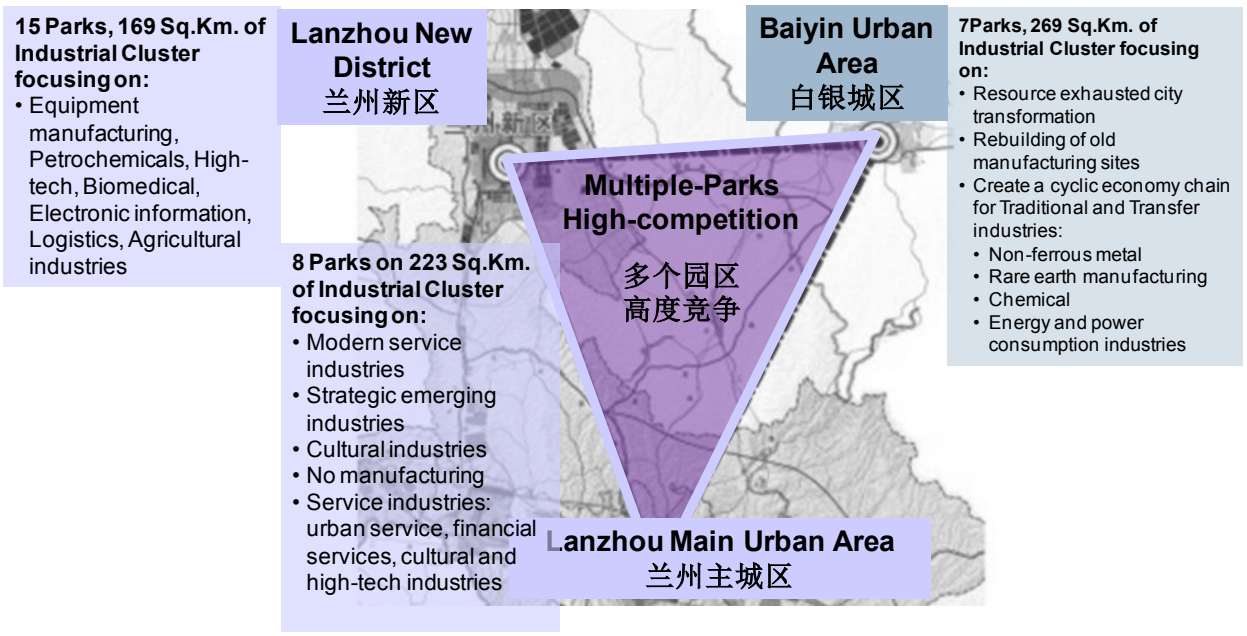


Figure 6: Layout of the core areas in Lanbai Economic Zone

21. **Lanzhou New District.** Lanzhou new district is positioned to be the new industrial cluster in the city with certain urban functions expanded, and the focus industries are equipment manufacturing, petro chemistry, high-technology, biomedical, electronic information, logistics and agriculture industries. Major industrial parks in Lanzhou new district are listed as below:

Lanzhou New District	Land Area	Development Direction
Petro chemistry Industrial Park	45 km^2	Develop petrochemical chain industries in this industrial park, including oil refining industry zone, fine chemicals industry zone and petrochemical material industry zone
Equipment Manufacturing Industrial Park	20 km^2	Mainly focus on heavy petrochemical equipment manufacturing, equipment for solar and wind energy generation systems, computer numerical control and related equipment and equipment manufacturing for automobile and railroad transportation.
Hi-tech Industrial Park	23 km^2	There are four major zones in this industrial park focusing on hi-tech related business: *Electronic information industrial zone*: cloud computing, GIS, electronic information and information services *New energy industrial zone*: solar energy, wind energy industry, distributed generation industry and smart grid *Biomedical zone*: bio-pharmaceutical industry, modern Chinese medicine and health industry, chemical pharmaceutical and biomedical engineering *New material zone*: new metal material, new rare earth material, new energy storage material and thin film solar cell
Logistics & Agricultural Park	21 km^2	Focus on logistics and modern technology agriculture developments
Administrative and Cultural Center Area	40 km^2	A centralized administrative and service providing site to serve the whole Lanzhou new urban district, including culture and tourism, financial services, convention and exhibition center, headquarters, business services, retail and city complex.
Technology Research & Development Industrial Park	20 km^2	Provide technological and knowledge education services, including vocational technical schools, hospitals, R&D centers and other educational institutions.

22. **Lanzhou main urban area.** Lanzhou main urban area is planned to develop modern service industry, strategic emerging industry and cultural industry; generally speaking, manufacturing industries will gradually be guided to move out of this area. The focus industries are urban service, financial service, cultural and high-tech industries. Major industrial parks in Lanzhou new district are listed as below by different levels:

National Level

	Area	Land Area	Development Direction
Lanzhou Hi-tech Industrial Development Area	Yanteng	12.36 km^2	Headquarters of Northwest China and Central Asian market with mix of business, technology development, business incubators, culture and technology
	Qilihe	21.52 km^2	Focus on equipment manufacturing and green energy industries, combining scientific research, education, headquarters economy, financial service, commercial and residential development in an area
	Yuzhong	136 km^2	Create sites for national level bio-industry and new material industry to develop new material, biomedical, medical equipment, business convention and exhibition, technology development and modern agriculture.
	New district expanded area	18 km^2	*Logistics industrial park at airport east*: logistics and warehousing and distribution services *Hi-tech industrial park at airport south*: electronic information, new material, software and service outsourcing, biomedical, business incubators and R&D centers
Lanzhou Economic Development	Anning	9.53 km^2	Focus on technological development and cultural education, and attract railroad logistics and transportation system to build cooperation connection towards northwest China and Central Asia

Area	New district expanded area	26 km^2	*Hi-tech industrial park at airport north*: electronic information, biomedical, new material, new energy and a demonstrative site for civil-military industry *Logistics park at airport north*: logistics, warehousing and distribution *Modern agriculture demonstrative site*: agricultural products such as oil, meat and dairy processing, beer and drinks, roses, fruits and vegetables

Provincial Level

	Land Area	Development Direction
Xigu New Town Industrial Park	5.5 km^2	Mainly focus on fine chemicals, carbon fiber and new material, rolled glass, industrial nonwoven fabric and logistics
Lianhai Development Area	31.5 km^2	Develop processing industries such as nonferrous metals and new materials, aluminum, carbonaceous products, ferroalloy, mineral products from Qinghai-Tibet Plateau, Muslim biomedical and food, dairy and vegetables
Yuzhong Heping Industrial Park	11.6 km^2	Focus on precious metal material R&D and industrialization, mechanical engineering and senior vocational education and training
Jiuzhou Development Area	7.78 km^2	Focus on food processing, clothes and furniture manufacturing, printing, packing and other commodity industries

23. **Baiyin urban area.** Baiyin urban area is developed with the purposes of creating a cyclic economy, resource exhausted city transformation and old manufacturing site rebuilding. Based on the existing industrial advantages, it is planned to create a cyclic economy chain containing non-ferrous metal and rare earth manufacturing, chemical, energy and power consumption industries. Major industrial parks in Lanzhou new district are listed as below by different levels:

National Level

	Land Area	Positioning	Development Direction
Baiyin Hi-tech Industrial Development Area	116.86 km^2	• The initiator of industrial transformation in Baiyin • A cluster of advanced manufacturing industries in Gansu • The forerunner of cyclic economy	Develop chemicals and fine chemicals, nonferrous metals and new material, biomedical and medical equipment, high-end equipment and bronze art ware industries

Provincial Level

	Land Area	Positioning	Development Direction
Liuchuan Industrial Concentrated Area	50 km^2	• The platform for key industrial transformation projects in Baiyin • Strategic position in Lanbai Core Economic Zone • The cyclic economy demonstrative area in the province	Focus on rare earth and new material industry, nonferrous metals processing, coal chemical industry and logistics
Pingchuan Economic Development Area	20 km^2	• The capital of pottery industry in northwest China • The green industry demonstrative area in the province • The facilitator of development in Pingchuan and Jingyuan	Focus on pottery industry, new material industry, agricultural product processing and mining equipment manufacturing

County Level

	Land Area	Positioning	Development Direction
Small and Medium Enterprise Base		• Urban industrial centralized zone featuring a cluster of small and medium enterprises	Focus on rare earth and new material industry, nonferrous metals processing, coal chemical industry and logistics
Jingtai Industrial Concentrated Area	62.8 km^2	• The platform to develop economy at county level • The base for construction material industry and new energy industry	Develop industries including new energy, new construction materials, non-metal mineral product processing and agricultural product processing
Huining Industrial Concentrated Area	9.56 km^2	• The main platform for industrial cluster development in the county • Featured agricultural products processing industrial park in Lanbai Economy Zone • The base of grass industry development in northwest area	Focus on agricultural product processing industry, light textile industry, livestock and grass industry, business and trading and logistics
Yin Triangle Non-Public Economy Concentrated Area	10 km^2	• A cluster of non-public economy industries and service industries • The connector between Jingyuan and Pingchuan economic development area • Plan to create Jingyuan industrial belt along Baiyin 109 line	Develop chemical industry, construction material industry and agricultural product processing

24. As a result of the regional industrial development, there is more than 700 km^2 of land for industrial parks in Lanzhou and Baiyin region. Most of the industrial park projects have been planned but not yet built or operated.

25. LIP will have advantages as it is being positioned as the key industrial park in the province for large-scale industrial projects and has good potential for expansion. LIP's strongest competitors are Baiyin Industrial Hi-Tech Development area.

Baiyin's Positioning and the Role of LIP

26. **Baiyin Municipality is a resource-based city. Looking back at its history, Baiyin has experienced 4 stages of development:**

- Stage 1: The formation and rapid development phase (1953-1963)
- Stage 2: The swift expansion of mining and metallurgical industry (1963-1985)
- Stage 3: The resource depletion and economic depression phase (1985-2005)
- Stage 4: The economic and social transformation (2005-currently)

27. **Currently Baiyin is at a critical phase of economic transformation and development.** In 2008, Baiyin Municipality was officially listed as one of the first resource-exhausted cities in transition and is a potential recipient of a special fund set up to support the resource-exhausted cities that are able to show potential for employment absorption, integrated resource utilization and undertaking of alternative industrial development projects.

28. Through initial field survey, interviews with government officials, and analysis of existing literature and data, it is observed that Baiyin Municipality's economic development is undermined not only by resource depletion, but also by the problems on industry and ownership structure, the city's spatial layout, urban-rural disparity, and environmental pollution.

(i) *Resource Depleted City.* The municipality has suffered a prolonged period of economic depression, and has dropped in ranking among municipalities within Gansu.

(ii) *Secondary Industry Driven.* Data shows Baiyin Municipality's industrial structure is driven by the secondary sector – industries – with a growing share of service sector industries.

Year	GDP (in CNY Million)	Industrial composition			Industrial growth rate		
		Primary industry	Secondary industry	Tertiary industry	Primary industry	Secondary industry	Tertiary industry
2007	20,752	13%	56%	32%	6%	17%	9%
2008	24,832	12%	56%	31%	7%	15%	9%
2009	26,533	12%	55%	32%	5%	13%	10%
2010	31,118	12%	55%	33%	6%	18%	10%
2011	37,579	11%	57%	31%	7%	16%	13%
2012	43,377	11%	57%	32%	7%	17%	14%

Table 3: GDP of Baiyin Municipality and its industrial structure change

(iii) *Strong Heavy Industry Base.* In 2012, heavy industries accounted for 85% of its Gross Industrial Production Value.

Year	1985	1990	1995	2000	2005	2007	2012
Industrial production value (CNY10,000)	91,750	245,522	673,060	1,037,207	2,005,237	3,173,818	6,473,191
Nonferrous metals industry	60%	51%	40%	38%	36%	39%	44%
Chemical industry	2%	6%	6%	4%	8%	12%	14%
Energy industry (electric power, mainly coal-based)	8%	3%	10%	29%	32%	27%	27%
Agricultural and livestock production	3%	-	1%	2%	4%	3%	4%
Building materials industry	4%	2%	3%	3%	3%	2%	2%
Machinery manufacturing industry	8%	4%	4%	4%	1%	2%	2%

Table 4: Baiyin's Share of Major industries, in Total Industrial Production Value

(iv) *Single ownership structure undermining the role of the dominant industries.* The central and provincial industries are the backbones of the municipality's industrial economy. In 2012 industrial value added accounted for 72% of total. In the era of the planned economy, under the guidance of national mandatory plans, Baiyin Municipality exported primarily low value-added processed products outside of the province. There was not much thinking regarding what the priority industries should be and as a result the dominant industries and local economic industries were not able to successfully lift the development of the local economy. This suggests some weaknesses in the municipality's strategic planning and development capability.

(v) *Industry Underperformance.* Poor performance of enterprises lead to several years of layoffs, low salaries, and talent outflow as can be seen in the chart from 1990 to 2012.

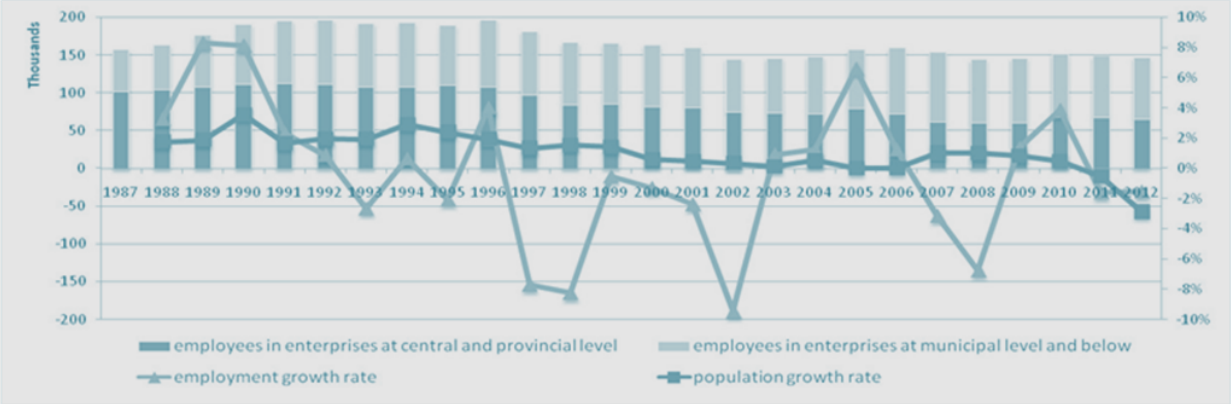


Figure 7: Changes of numbers of employees of Baiyin Municipality through the years

(vi) *Dispersed development and heavy industry pollution.* Baiyin has had unplanned and sporadic developments. Apart from this, there has been a focus on heavy industry development leading to high levels of pollution in urban and rural areas. It would be advantageous for Baiyin Municipality to review its current land use strategy, moving from a scattered industrial layout towards a more organized industrial cluster development. Environmental pollution and ecological deterioration of Baiyin caused by mining and smelting is very serious.

(vii) *Persistent urban-rural disparity in Baiyin.* Even with industrialization, Baiyin Municipality failed to drive urbanization to the benefit of the majority. About 75% of the population is still living in impoverished rural areas.

(a) *Urbanization has not kicked off despite industrialization.* In 2012, despite being an industry dominated city, Baiyin Municipality's agricultural population represented 72% of the total population and the municipality remained predominantly rural.

(b) *Agricultural counties have limited self-development capacity and surplus rural laborers have become a serious social problem.* LIP is located in Jingyuan County, which is a typical agricultural county and is considered as one of nation's destitute regions. In 2012, the county's GDP was CNY5.4 billion, while its economy remains predominantly agricultural. This can be seen in the county's registering 161,500 people living below the poverty line and a poverty incidence of 37%. Organizing migrant work has become an important way to accommodate surplus rural labor, but this has also led to social problems such as 'orphaned children/ left behind' and 'elderly empty nesters.

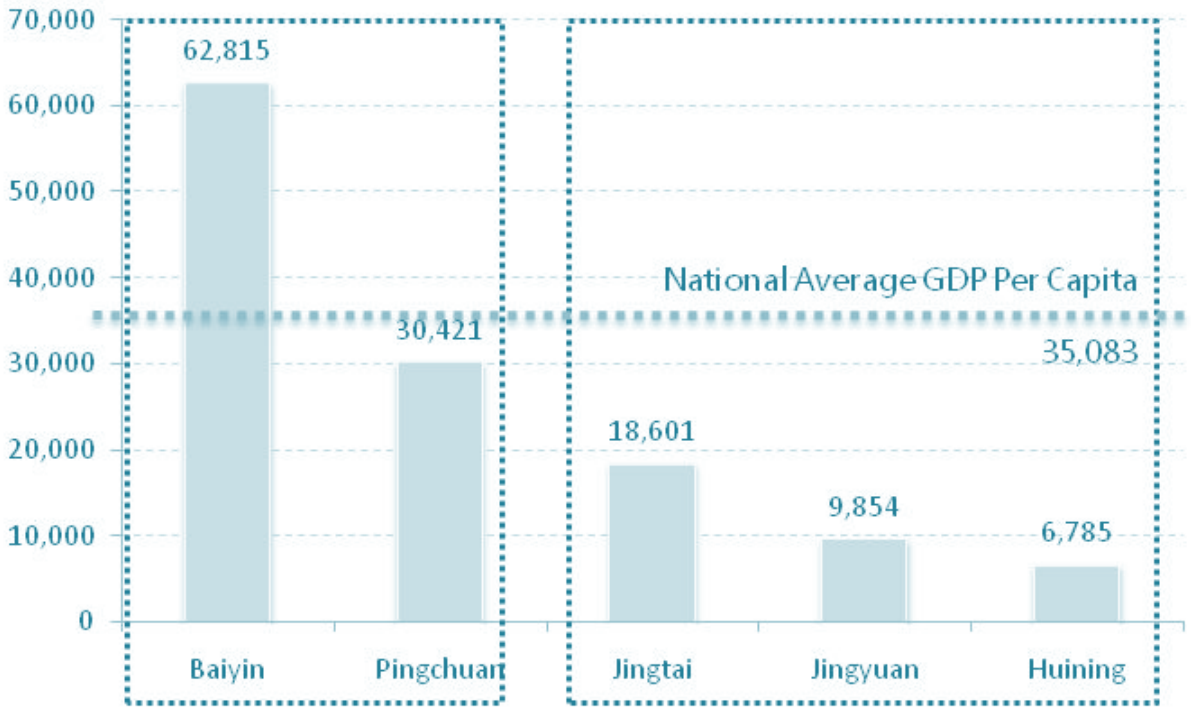
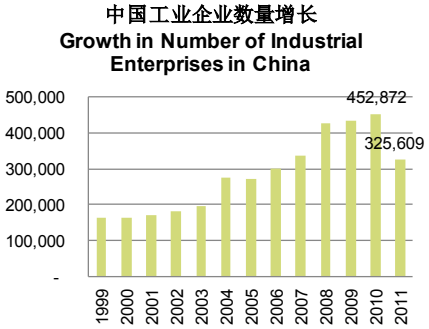


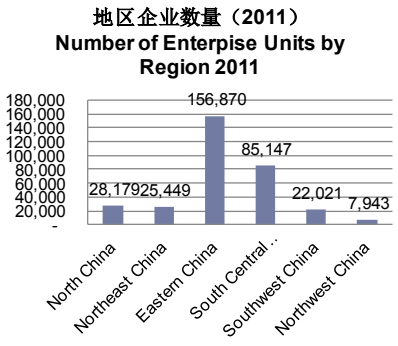
Figure 8: Comparison of per capita GDP in the districts and counties of Baiyin Municipality in 2012

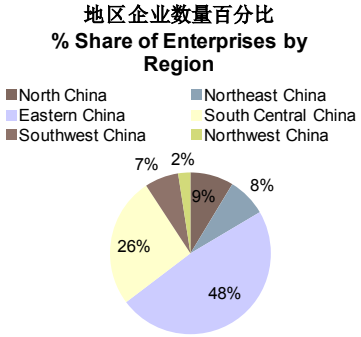
Broad Industry Sector Analysis

29. The following comparative regional industry performance reveals some statistics regarding industrial sector performance in terms of numbers of enterprise units, output value and numbers of employees.

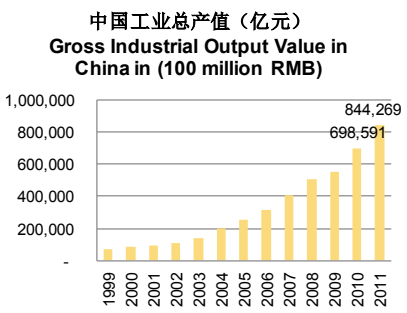
(i) Northwest China lags behind other regions in terms of numbers of enterprise units. Its share of private enterprise units is only 30% of its total number enterprise units.

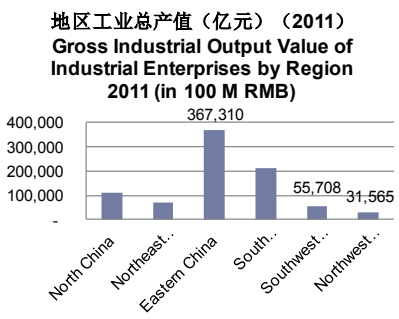


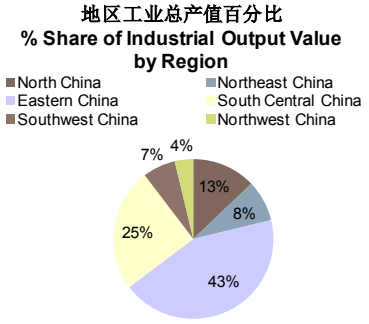




(ii) Even with Western China's output value of industrial enterprises increasing annually at 23% it is only about ¾ of Eastern China's total output value.

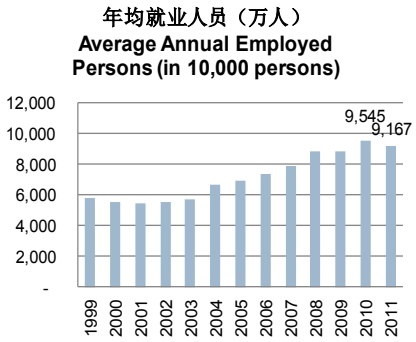


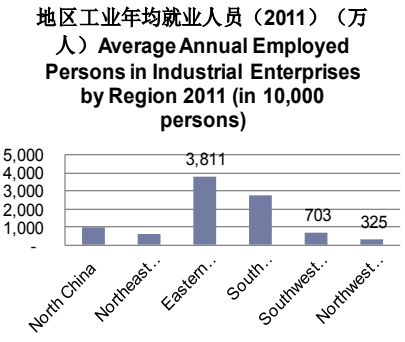


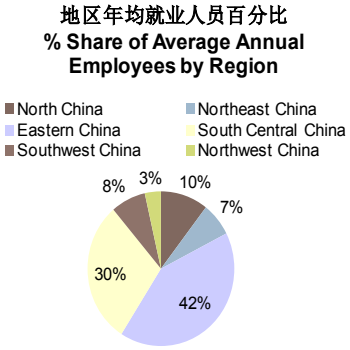


(iii) Output value of private enterprises in the Western region is minimal at 12% suggesting the dominance of public enterprises.

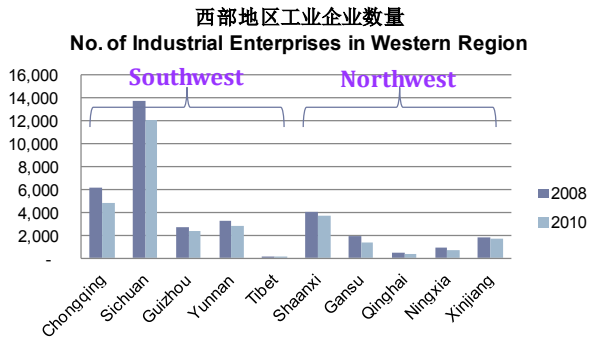
(iv) Industrial employees in Western China represent about 3% of the national number, however, growing at a compounded annual growth of 5%.

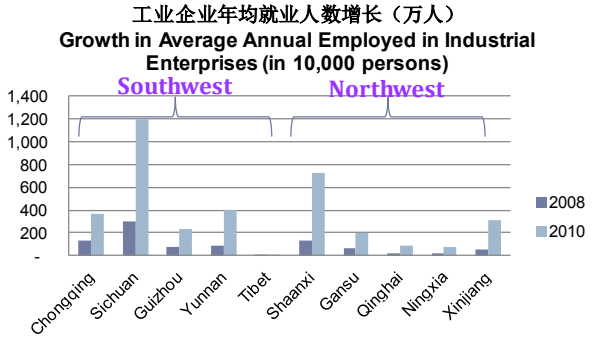


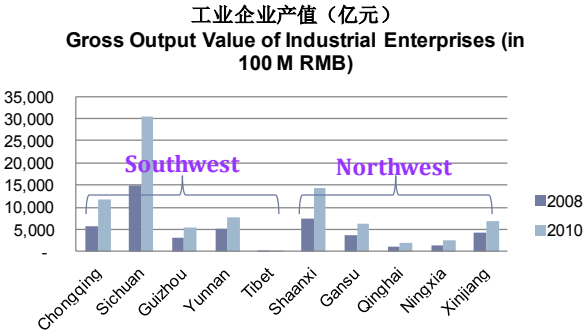




(v) In general, Gansu province lags behind ranking 7th in the Western Region in terms of numbers of enterprises and employed in industry. Gansu ranks 6th in terms of output value.







30. In terms of contribution to the PRC's volume of industrial output, the following findings reveal that:

(i) Western China has significant contribution to the PRC's natural gas, hydropower, sulfuric acid, chemical fertilizers, cigarettes, crude oil, salt, cement, soda ash, and electricity industries' total output value.

Ranking By Volume	Top Industries of West China	West China as % of the PRC
1	Natural Gas	82%
2	Hydropower	54%
3	Sulfuric Acid	41%
4	Chemical Fertilizer	35%
5	Cigarettes	32%
6	Crude Oil	30%
7	Salt	28%
8	Cement	22%
9	Soda Ash	22%
10	Electricity	21%
11	Refined Sugar	19%
12	Caustic Soda	18%
13	Micro Computers	15%
14	Metal-Cutting Machine Tools	15%
15	Primary Plastic	15%
16	Motor Vehicles	13%
17	Cars	13%
18	Beer	13%
19	Integrated Circuits	13%
20	Plate Glass	12%

(ii) Northwest China supplies over 50% of Western China's ethylene, crude oil, primary plastics, integrated circuits, natural gas and caustic soda.

Ranking By Volume	Top Industries of Northwest	Northwest China as % of West China
1	Ethylene	100.0%
2	Crude Oil	99.7%
3	Primary Plastic	81.0%
4	Integrated Circuits	70.7%
5	Natural Gas	68.4%
6	Caustic Soda	60.5%
7	Electricity	45.0%
8	Pig Iron	40.4%
9	Soda Ash	39.8%
10	Crude Steel	39.1%
11	Rolled Steel	38.1%
12	Yarn	38.0%
13	Beer	37.5%
14	Chemical Fertilizer	36.1%
15	Metal-Cutting Machine Tools	33.1%
16	Chemical Fiber	32.9%

17	Cement	32.1%
18	Cars	30.3%
19	Salt	27.3%
20	Plate Glass	27.1%

(iii) Gansu's main contributions to Northwest China are on volume of integrated circuits and household washing machines. Gansu supplies over 20% of Northwestern China's sulfuric acid, ethylene, crude steel, hydropower, cigarettes, pig iron, rolled steel, beer, plate glass, and electricity.

Ranking By Volume	Top Industries of Gansu	Gansu as % of Northwest China
1	Integrated Circuits	100.0%
2	Household Washing Machines	100.0%
3	Sulfuric Acid	48.7%
4	Ethylene	40.0%
5	Crude Steel	31.0%
6	Hydropower	29.5%
7	Cigarettes	28.7%
8	Pig Iron	27.5%
9	Rolled Steel	27.3%
10	Beer	27.0%
11	Plate Glass	23.4%
12	Electricity	22.7%
13	Primary Plastic	21.4%
14	Cement	18.4%
15	Metal-Cutting Machine Tools	13.4%
16	Soda Ash	9.6%
17	Chemical Fertilizer	9.5%
18	Caustic Soda	9.0%
19	Cars	5.1%
20	Motor Vehicles	3.6%

(iv) Overall, there continues to be strong growth in the industrial sector. Recycling and disposal of waste, mining and processing of metal/non-metal ores, production and supply of gas as well as several other manufacturing and processing industries have experienced compound annual growth rate (CAGR) of between 20% and over 50% from 2008 to 2010.

Identification of Priority Industries by PRC Government

31. The National Development and Reform Commission (NDRC) and Ministry of Commerce (MOC) released the catalogue of priority industries for Central and Western China. The catalogue is the basis of applicable policies for guiding the examination and approval of foreign investment projects and enterprises. For Gansu the following are the priority industries:

- Production of whole vehicles (with Chinese majority ownership)
- Production of fruits, vegetables, flower seeds (Chinese party as controlling shareholder)
- Processing of high-end rare earth application products
- Public service construction and operation of urban gas, heat, water supply and drainage systems

- Construction of high quality wine grape bases
- Broadband business services and value-added telecommunications business
- Health and senior care services
- Cultivation and processing of high-quality beer raw materials
- Highway transportation companies

32. These industries will receive the highest attention from government and the highest interest from investors.

33. The following key conclusions from the analysis guide the selection of industries for Gansu Baiyin's LIP:

(i) Must consider the province's resource advantage in relation to other provinces and regions;
(ii) Has the potential to build up the featured economy – green economic zone / sustainable industries;
(iii) Should have upstream and downstream potential;
(iv) Promotes the transfer of industries from the Eastern / Coastal regions;
(v) Has a strong market orientation / strong market support;
(vi) Can help underemployment – transition existing workforce into a industry focused workforce or build a supporting service based workforce;
(vii) Can attract and retain necessary workforce;
(viii) Has the potential to promote a circular economy;
(ix) Has the potential to accelerate industrialization and urbanization;
(x) Is attractive to domestic and foreign investors.

Short-Listed LIP Industries

34. The main criteria used for selection of appropriate LIP industries are industrial foundation, local resource endowment, and market prospect, development conditions of the site and extent of environmental impact reduction by creating a closed-loop industrial chain.

35. A review of the existing industrial bases in Baiyin Municipality and the government's industrial policy orientation suggests that LIP continues to rely on the existing industrial base; the TA Consultants look into the development of rare earth new materials industry, non-ferrous metal deep processing industry, coal chemical industry, equipment manufacturing industry, building materials industry, and industrial warehousing and logistics industries, as well as those industries that may increase investments and attract a cluster of industrial projects.

Selected Industry	Market Prospect	Attractiveness of Development Conditions	Development Direction
Rare Earth New Materials	▪ Used in the emerging technologies; ▪ National policies encourage the expansion of the downstream rare earth new materials deep-processing industry.	▪ The most important rare earth metallurgical processing company in northern China, with the most advanced technology, is located near LIP.	▪ Explore downstream rare earth deep processing industry; ▪ Establish Gansu Province's rare earth industrial base; ▪ End products market: liquid crystal display, green lights, permanent magnet motor, Ni-MH battery, luminescent material, etc.
Non-Ferrous Metal Deep Processing	▪ National government accelerating structural adjustment for non-	▪ Non-ferrous metals industry is competitive industry of Baiyin even	▪ Established aluminum electrolysis plants to develop integrated coal-

	ferrous industries; ▪ Reducing cost is key and businesses are encouraged to relocate to energy-rich areas; ▪ Value of production is going to be reviewed.	if declining in production volume; ▪ Location advantage and development condition make Baiyin attractive to acquire mineral sources from Qinghai-Tibet Plateau.	electricity-aluminum projects; ▪ As well as deep-processing downstream aluminum alloy products
Equipment Manufacturing	▪ The development of this industry is in line with national industrial policy; ▪ Fast-growing new energy industry in Gansu will bring a huge demand for its equipment; ▪ Fast-growing automotive in western China will increase the local demand for auto parts.	▪ Near the wind energy equipment manufacturing base in Lanzhou; ▪ Near the auto manufacturing base in Lanzhou	▪ Key parts of new energy equipment, such as wind turbines, control systems, special cables, etc.; ▪ Auto parts, advice and accessories for Lanzhou's automobile production base
Coal Chemical	▪ The PRC will continue largely relying on coal power for its energy for energy security purpose; ▪ It is cost competitive as a substitute for oil chemical products; ▪ Strong support for new coal chemical industry from national government, especially in the energy-rich Western Region.	▪ Accessible to enough coal and water resources, which is vital to coal chemical industry; ▪ Its arid and semi-arid continental climate can reduce air pollution; ▪ Accessible to pipelines for west-east gas and oil transmission project, and convenient transportation network	▪ Current reliable and profitable downstream products, including coal-to-oil and coal-to-natural gas
Building Materials	▪ Urban construction will increase demand for cement, ceramics and other building materials.	▪ Baiyin's advantage in raw materials is its richness in clay resources of up to 4 billion tons. ▪ The ceramics industry developed rapidly in recent years in Baiyin.	▪ Production of sanitary ceramics, special ceramics, domestic ceramics, gardening, furnishings art, etc. ▪ Establish itself as a base of ceramic product manufacturing in northwest.
Warehousing / Logistics	▪ Production output-based economy makes it dependent on external transportation; ▪ Will have market demand for the development of industrial logistics	▪ Leverage on roads and railways running through and around the park to provide efficient distribution	▪ Great potential of developing into an industrial warehousing and distribution center serving the region

Industry Analysis and LIP Positioning

LIP Positioning

Role of LIP in Supporting the Economic Transformation of Baiyin

36. LIP is considered a key industrial development area both for Gansu province and Baiyin Municipality as part of the 'One Zone and Six Parks' development. LIP is expected to put forward Baiyin's economic transformation:

(i) Identified as of the most important heavy industries industrial park in Baiyin and in Gansu. In the *Overall Planning of the Development of Baiyin Municipality's Development Zone (industrial concentration district) (2011-2020)*, LIP is planned to be constructed as a provincial level economic and technological development zone.

(ii) Identified as the center of 'Lanbai (Lanzhou-Baiyin) Economic Core Zone' for receiving industrial transfers from Eastern and coastal regions expected to diversify Baiyin's economy away from natural resources towards equipment and new materials manufacturing.

(iii) Provides an ideal relocation area to consolidate large-scale industries into clusters currently scattered throughout the city.

(iv) Allow for the clustering of heavy industries according to their upstream and downstream industries.

(v) Accelerate Jingyuan County's industrialization and urbanization through the provision of more job opportunities, alternative non-agricultural livelihoods and potentially higher income for rural households.

(vi) Willing to adopt the concept of circular economy where Baiyin can transition from a heavily polluting and high resource dependent to an eco-friendly economy.

Liuchuan Industrial Positioning

37. LIP has strong potential to be developed and presents a good relocation area for large to medium-sized industries.

(i) *Location advantage and easy access to major cities.* The park is centrally located in relation to Lanzhou (at a distance of 100 kilometers), Xining (at a distance of 400 kilometers), and Yinchuan at a distance of 330 kilometers. It is only 18 kilometers from Baiyin Municipality's main urban area and only 15 kilometers away from Jingyuan County seat.

(ii) *Potentially Good transportation access.* Baiyin-Baojishan Railway, Beijing-Tibet expressway, G109 National Road, and S207 Provincial Road alignments run through LIP. And LIP can take advantage of this by providing a dedicated and planned access way from these major roads.

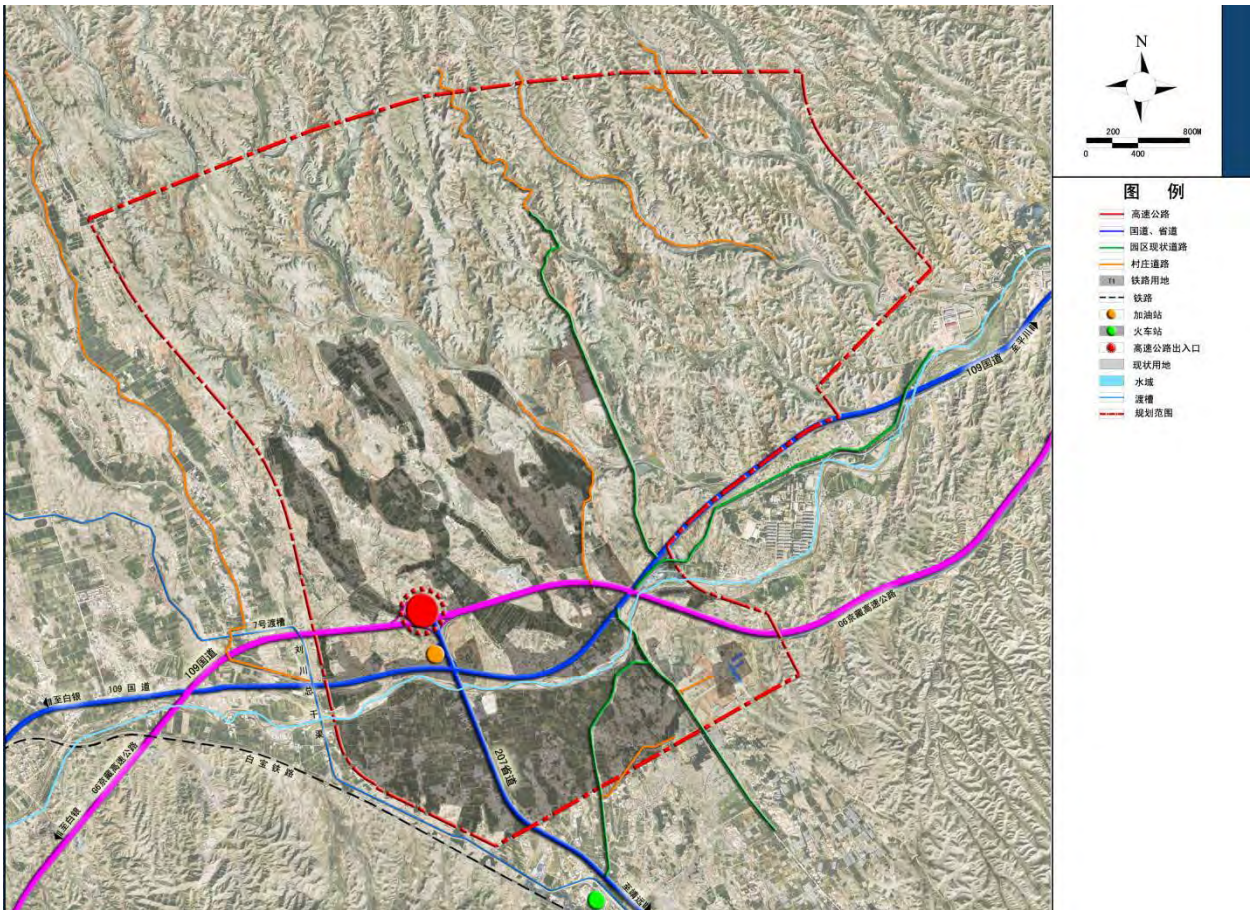


Figure 9: Map showing existing roads of Liuchuan Industrial Park

(iii) *Availability of Large Developable Land or Expansion Area***.** The park's overall planning area of 50 square kilometers (or 5,000 hectares) is adequate for the construction of an industrial township. However, wasteland and barren mountains account for more than 80% of the planned area. There is little arable land and there are few existing residents. There are few potentially affected households and little need for resettlement.

(iv) *Abundant Coal and Electricity Source.* Gansu Province is rich in coal resources with adequate power supply. There are high quality coal resources from Xinjiang that can be explored and processed in Baiyin.

(v) *Abundant and Available Water Resource.* 258 kilometers (or 52% of the entire length that runs through Gansu Province) of the Yellow River flows through Baiyin. The park is 10 kilometers from Yellow River intake. It is estimated that the daily water supply capacity can be up to 100,000 cubic meters, and the wastewater treatment capacity can be up to 130,000 cubic meters to support both domestic and industrial water requirements.

Existing Land Use in LIP

38. Under LIP short-term plan, LIP has a total of 900 hectares of industrial land or about 38% dedicated to industrial use.

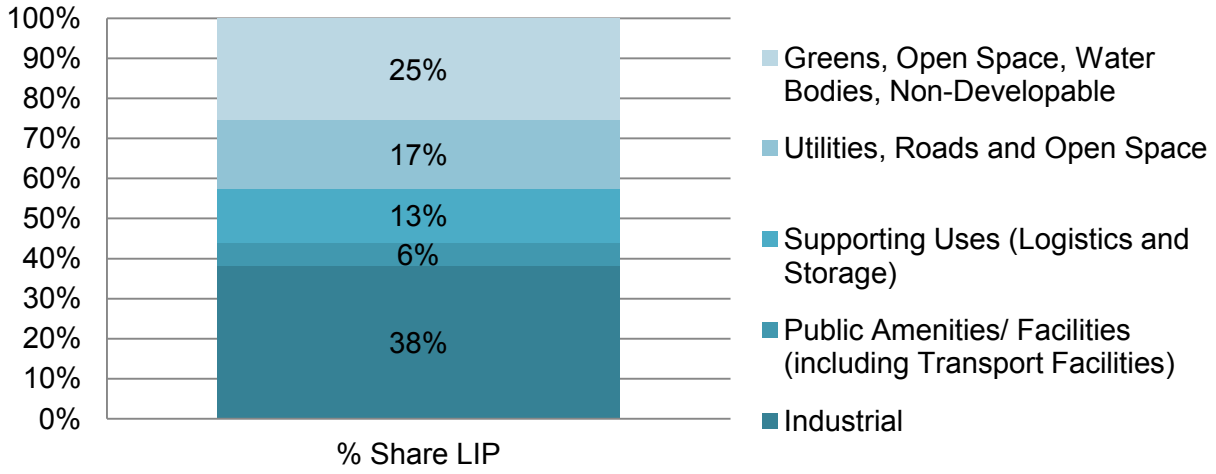
LIP Land Use Breakdown (in Hectares)

Code		Land Use	Land Area (Ha)
C	C	Public Amenities/Facilities	103.2
	C1	Administrative Office	45.1

	C2	Commercial/Finance Business Office	13.8
	C3	Cultural and Leisure	13.7
	C6	Education and R&D	30.3
	C9	Other Public Amenities/Facilities	0.4
M	M	Industrial	887.7
	M2	2nd type of industrial space	550.7
	M3	3rd type of industrial space	337.0
W	W	Storage	310.8
	W1	Normal Storage Space	310.8
T	T	External Transportation	30.4
	T1	Railway	11.0
	T21	Highway	15.2
	T23	Long Distance Bus Terminus	4.2
S	S	Road Open Space	310.7
	S1	Roads	301.5
	S22	Gathering Square for People	7.3
	S3	Public Parking	2.0
U	U	Infrastructure	86.7
	U11	Water Supply	8.8
	U12	Electricity Supply	10.7
	U13	Natural Gas Supply	10.0
	U14	Heat Supply	8.6
	U21	Public Transportation	1.9
	U29	Other Transportation Facilities	1.2
	U3	Postal, Electrical Facilities	0.8
	U41	Rainwater, Wastewater Management	26.4
	U42	Solid Waste Management	0.2
	U7	Flood Prevention Facilities	17.1
	U9	Other Infrastructure	1.2
G	G	Green Space	554.8
	G11	Park	232.7
	G12	Street Greenery	102.0
	G22	Protected Green Space	220.1
	Sub-Total: Urban Development Space		2,284.3
E	E	Water Bodies, Other Non-Urban Development	34.4
	Of which	Water Bodies	22.6
		Mountains	11.8
Total Planned Area			2,318.7

39. On top of the industrial use, there is a 36% non-industrial use breakdown for public amenities / facilities (6%), supporting uses like logistics and storage (13%) and utilities, roads and developed open space (17%).

Figure 10: Land Use Breakdown LIP (in Percent Share)



Industry Analysis and Context

Rare Earth Building Materials Industry

Rare Earth

40. **Overview.** Rare earth elements (REEs) are valuable strategic resources, widely used for many commercial applications including emerging technologies, electronic devices, automobiles and national security applications. The demand for REEs is derived from the production of their end use products, such as flat panel displays, automobiles, catalysts etc. The United States was once self-reliant in domestically produced REEs, but over the past 15 years has become 100% reliant on imports, primarily from the PRC, because of lower-cost operations. As world demand continues to climb, the PRC continues to maintain its near-monopoly position in REEs.

41. The prospect of rare earth new materials industry is very promising. Reserves of rare earth resources in the PRC have been raised to a national strategic level. Domestic enterprises are encouraged to extend to the downstream chain of rare earth new materials deep processing, and foreign deep processing enterprises are encouraged to open factories in the PRC.

42. **Existing Conditions**. LIP has the industrial base potential for developing rare earth new materials. Gansu Rare Earth New Material Ltd., based in LIP, is one of the more important rare earth enterprises with the most advanced production technology. The company was established in the area even before the LIP was built. The company plans to expand production on a large scale, with planned area to be increased to 3.4 square kilometers. Currently, it takes 10-12 hours for raw material to be transported from Baotou by trucks. The company is focused on rare earth processing and separation, rare earth metals, rare earth abrasives, new earth hydrogen storage materials, rare earth florescent materials and rare earth permanent magnet materials.

43. A rare earth new material industrial park is being developed within the 23 sq. km. starting area; and 5 projects have been or will be introduced in this park. These projects as estimated by locators can expand the industrial scale of new materials made with rare earth.

Table 4: Rare Earth Projects Introduced in 23 km^2

	Land Area (m^2)	Output Value (CNY billion)	Tax (CNY billion)	Employment (person)
Rare earth smelting water resources integrated utilization	84,453			
High performance rare earth polishing power for LCD glass	31,137	1	0.13	

Industrial production of oxalic acid	62,380	0.573	0.05	600
High-performance rare earth trichromatic compact fluorescent lamps (proposed)	33,480	0.69	0.04	1,000
Cobalt smelting and integrated utilization production (proposed)	962,550	1		

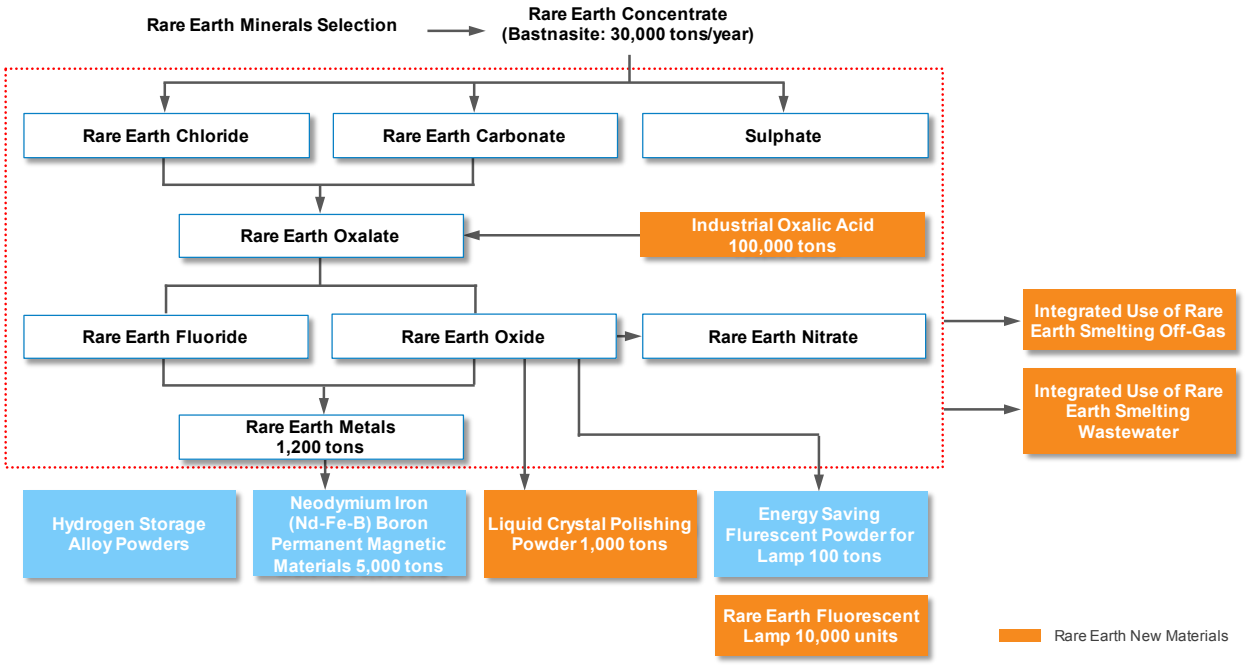
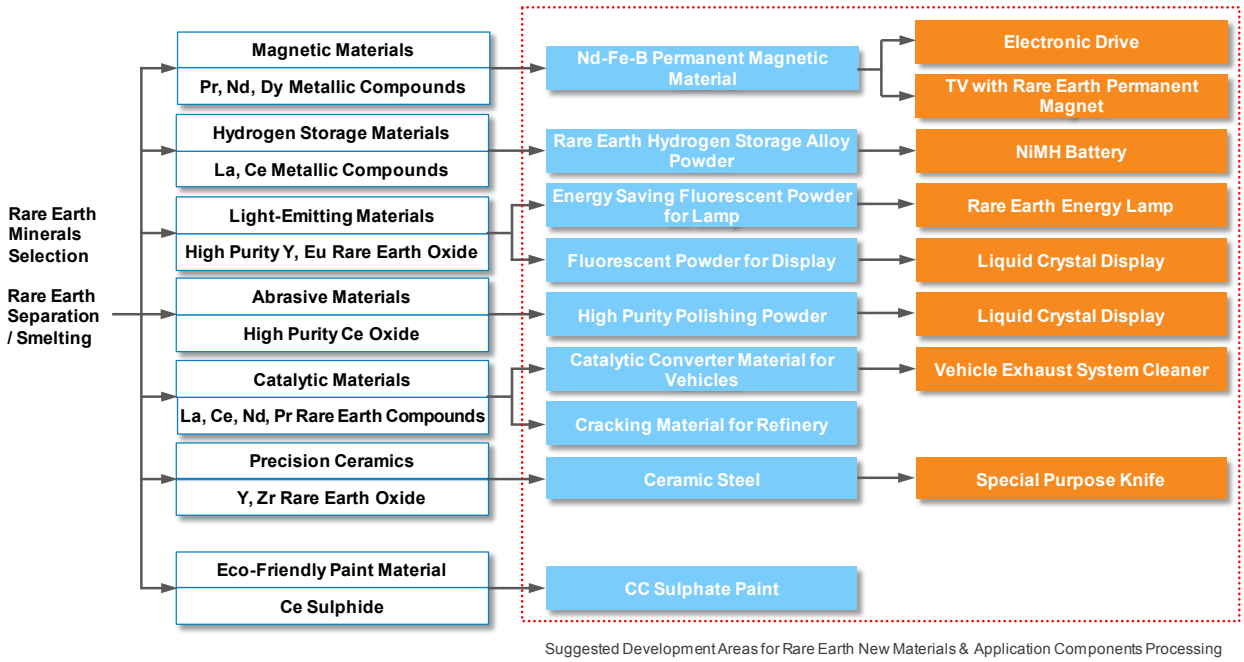


Figure 11: Current Rare Earth Industrial Chain in Baiyin

44. **Considering the rare earth industry's trends and its industrial policies, and existing enterprises in LIP, it is recommended that LIP will explore related downstream products,** such as liquid crystal display, green lighting, permanent magnet motor, nickel-metal hydride batteries, light equipment, etc. It is possible that utilization efficiency and output benefit will be greatly improved.



Suggested Development Areas for Rare Earth New Materials & Application Components Processing

Figure 12: Recommended Rare Earth New Material Products

Building Materials Industry

45. **Overview.** The park possesses market demand, resource base and industrial base for the development of the building materials industry. Even with the concept of developing an industrial cluster, supporting non-industrial uses will be required to form an industrial township. With development comes construction requirements and increasing demand for cement, ceramics and other building materials. A number of modern building materials enterprises have emerged in Baiyin Municipality in recent years including cement, ceramics, architectural ceramics, artistic ceramics, etc.

46. **Existing Conditions**. Two decorative building ceramic enterprises have been introduced into the LIP: Jiarui Ceramics Co. Ltd. is specialized in producing Western-style ceramic tiles, and Kaisi Ceramics Co. Ltd. is specialized in producing premium wall and floor ceramic tiles.

Table 5: Building Ceramic Enterprises in LIP

	Land Area (km^2)	Output Value (CNY billion)	Tax (CNY billion)	Employment (person)
Jiarui Ceramics	0.03	0.1	0.01	300
Kaisi Ceramics	1.6	5	0.5	7,000

47. Jiarui Ceramics Co. Ltd. is a local company of Baiyin Municipality and its plant is now in operation within LIP. LIP, being a new industrial park offering several preferential policies such as a 3-year tax exemption and providing easy access to raw materials in the area, successfully attracted Jiarui Ceramics to build its plant there. Currently, their main product is western-style ceramic tiles. In the future, the company plans to expand production to include wall tiles and floor tiles. These products are targeted at the low-end rural development market in Western China. The company has reflected that there is a severe water shortage within LIP, thus for companies to function more efficiently, water supply and other infrastructure needs to be improved as soon as possible.

48. Kaisi Ceramics Co. Ltd. is founded by a local entrepreneur from Baiyin Municipality and several ceramic companies from Foshan in Guangdong Province. The company chose LIP because of a promising regional market, relative lack of competitors and low land cost. Phase I and Phase II projects cover a land area of 914 mu (0.61 sq. km.), and the second production line of wall and floor tiles will be put into production in May 2014. Phase III and Phase IV projects include 3-4 production lines covering a land area of 1,000 mu (0.67 sq. km.). The total land area of the company is about 2,300 mu (1.53 sq. km.). Approximately 1,400 employees have been recruited, with the majority of them being local peasants or peasants from surrounding counties. The company also plans to provide in-house training for technical staff starting March 2014.

49. **Recommendations. In order to take advantage of increasing local market demands and ceramic resources, it is suggested that the park consider architectural ceramics products which together with Pingchuan Industrial Park can establish the northwest ceramic industrial production zone, targeting the northwestern market.** An architectural ceramic products zone can tap a larger market and industrial chain including developing sanitary ceramics products manufacturing, special ceramics manufacturing, domestic ceramics products manufacturing, gardening, furnishings, art and other ceramic products. Development of this industry in Liuchuan can benefit from enterprises from the Eastern Region's technologically advanced areas, encouraging local sanitary ceramics enterprises to enter.

50. **Socioeconomic Impact of Rare Earth and Building Materials Industry.** The output value of the rare earth and new building materials industry for Baiyin is estimated to be CNY15 billion by 2020 and CNY88 billion by 2030. Based on Baiyin's estimated output value compared with Gansu's estimated output value per employee per industry sector, the industry can support 11,700 (by 2020) and 59,900 (by 2030) employees. Cumulative new employment generated will be 4,500 people in 2020 and 13,400 people in 2030. A large percent of this is expected to be captured by LIP.

Estimated Land Use Demand

Non-Ferrous Metal Deep Processing Industry

51. **Overview.** Non-ferrous metals such as aluminum, copper, lead, zinc, nickel, titanium, cobalt, chromium and precious metals are most commonly used. Non-ferrous metals can be used in a variety of applications in the metallurgical, chemical, construction, and transport and electricity generation/transmission industries.

52. **The PRC's non-ferrous metals industry has entered into a period of adjustment. With the rising cost of electricity in the Eastern Region, the Western Region has a potential development advantage in this industry.** In 2009, the country issued the Adjustment and Revitalization Planning for Non-ferrous Metals Industry, showing that the PRC's non-ferrous metals industry has entered a phase of production control, closure of outdated production facilities and promotion of industrial upgrade. With the rising cost and a market downturn in recent years, effective cost control has become the key to the enterprises' survival and development, especially electricity cost control. The abundant power resources in the Western Region provide an opportunity to consider the revival of the non-ferrous metals industry.

53. **Existing Conditions**. Two non-ferrous metallurgical enterprises, Hongtai Aluminum Co. Ltd. and Hualu Aluminum Co. Ltd., have been introduced into the LIP. Both of them have integrated coal electricity generation with aluminum operations process to ease pressure on costs. Most of the products are among the mid-stream and upstream products. Since the market demands various downstream products, expanding to downstream deep-processing areas is full of potential and prospect.

54. Hongtai Aluminum Co. Ltd. was originally located in Xinyang County, Hubei Province. The company decided to relocate its aluminum production plant to LIP due to low electricity cost, availability of coal resources in the vicinity and hence a power plant for its own use. A railway dedicated to transporting coal from Qingyang's Huan County to LIP is currently under construction. Phase 1 of the plant's development covering a land area of 1.3 square kilometers will be completed soon, with an initial production capacity of 100,000 tons starting July 2014 and a targeted 500,000 ton production capacity by 2015. Phase 1 development mainly produces aluminum ingots. Under Phase 2, aluminum deep processing, production of aluminum alloys, plates and strips will be carried out. In addition, the company will have the logistics capability of handling 10 million tons of materials and products. The company has intentions to cooperate with other companies to carry out upstream production of carbon. 600 employees have been recruited for Phase 1, and the company estimates that additional 2 to 3 thousand employees will be needed upon full completion of the project. The company will carry out in-house technical training.

55. The aluminum enterprises in LIP report the following contribution in terms of expected output value and employment.

Table 6: Aluminum Enterprises in LIP

	Land Area (km^2)	Output Value (CNY billion)	Tax (CNY billion)	Employment (persons)
Hongtai Aluminum	4.67	30	2	2,600

Hualu Aluminum (Current)	1.28	3.2	0.173	1,557
Hualu Aluminum (Planned)	3.33	20	1.5	4,500

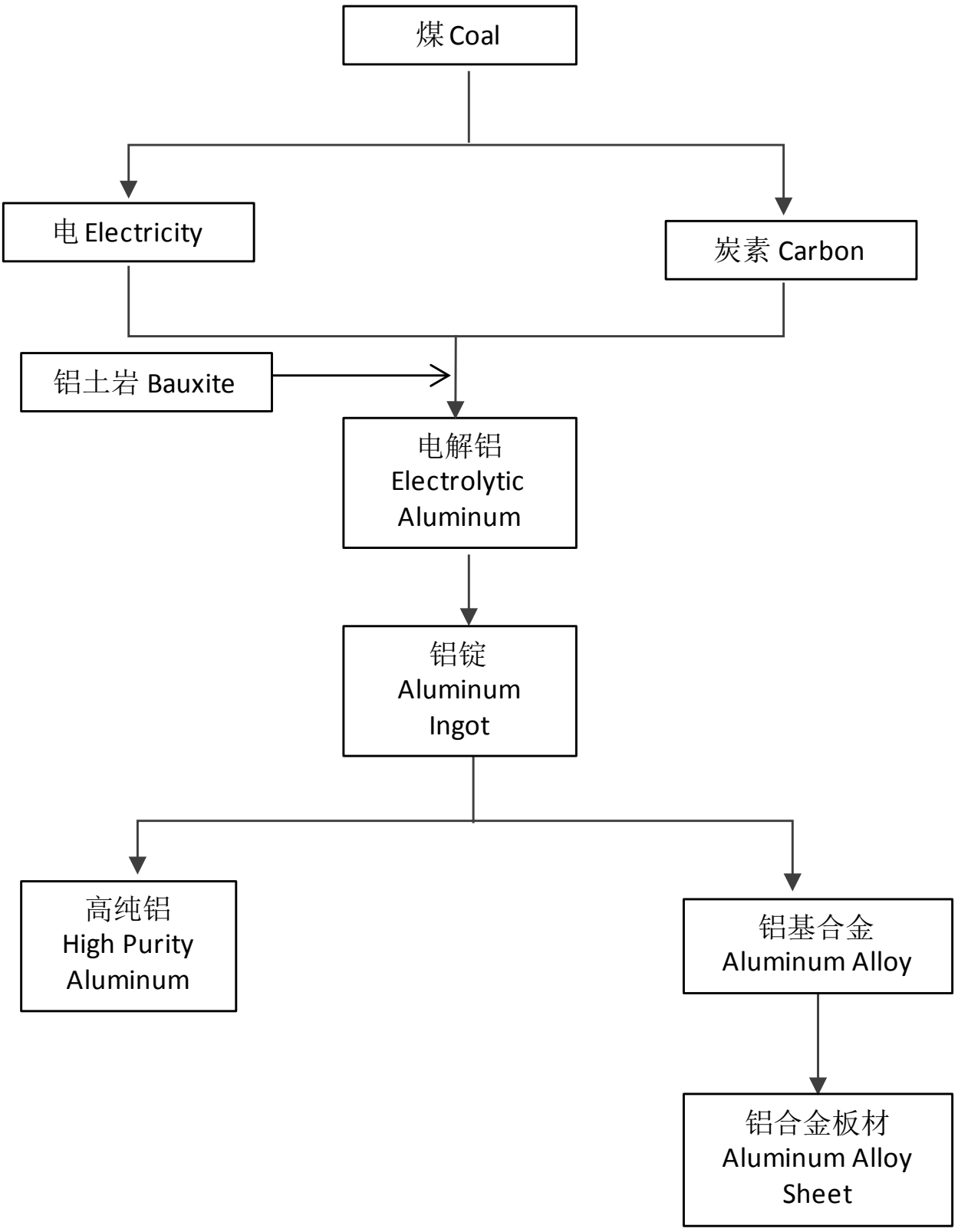


Figure 13: Current Aluminum Industrial Chain in LIP

56. Jingyuan Hongda Mining Co., which set up operations in the LIP area as early as 2005, is a local company of Baiyin Municipality. The company transports its raw materials, smelting

waste, from Baiyin Non-ferrous Metals Co., located 37 kilometers away. The remoteness of this area made it suitable for the company's heavy polluting operations. Due to plans to expand production scale this year, the company requires additional 0.67 sq. km. of land. Currently, the company's main product is lead bullion, which is then sold to provinces such as Hunan and Henan. There are future plans for more deep-processing, producing electrolytic copper as well as gold and silver products. Also, the company has established a cooperative relationship with Henan-based Xinxiang Xinye Metal Material Co. Ltd. for the production of non-ferrous metals.

57. **Recommendations**. Considering aluminum industrial policies and market demand, existing enterprises in LIP, spatial layout of non-ferrous industries in Baiyin, and target to build the large-scale nonferrous metal industrial base, it is recommended to develop aluminum alloys and deep-processing products featured with low cost, light weight, high strength, high-temperature and cauterization endurable. LIP should focus on building aluminum industrial cluster combined with deep processing industry of other non-ferrous metals, such as lead and zinc. Aluminum products include construction and building materials, household electronics, mechanical equipment, car engine frame and beverage cans.

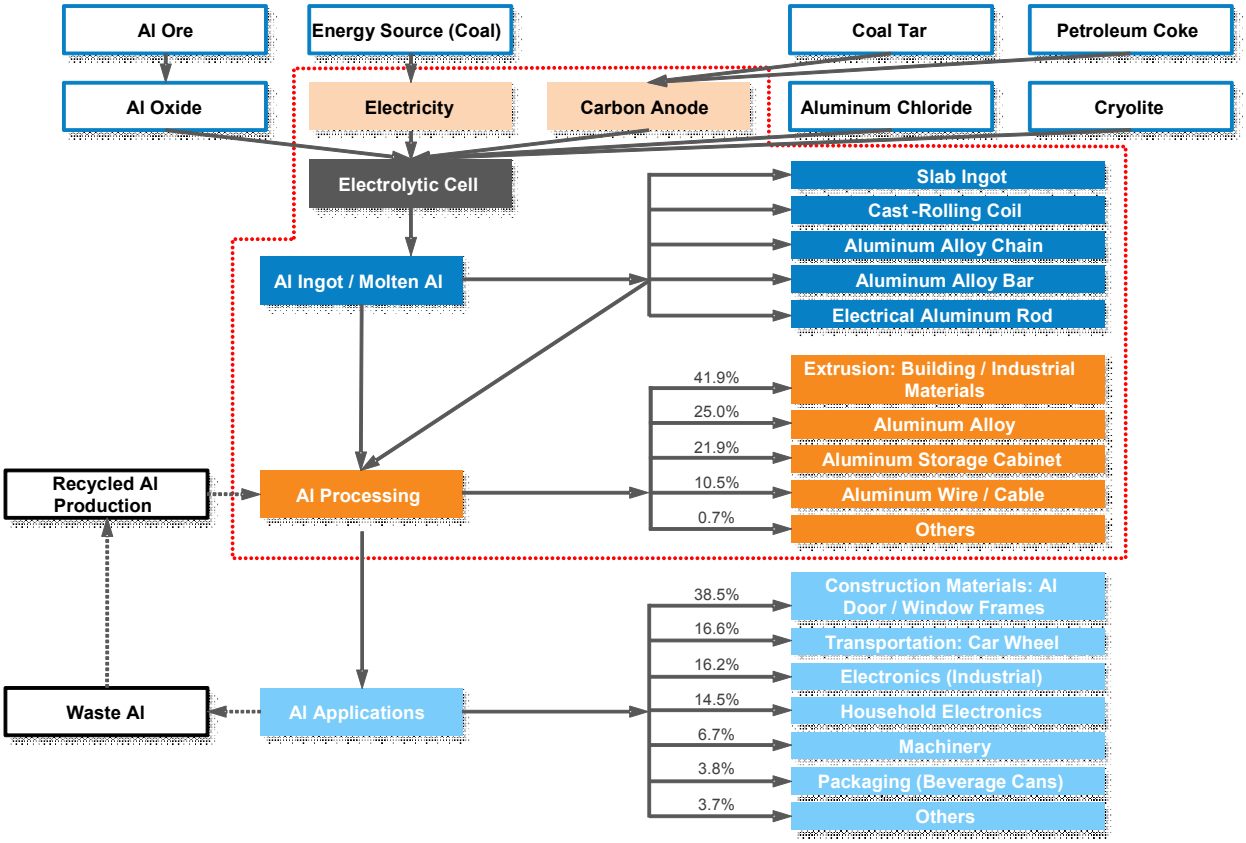


Figure 14: Recommended Aluminum Products

58. **Socioeconomic Impact.** The output value of non-ferrous metal deep processing industry for Baiyin is estimated to be CNY53 billion by 2020 and CNY146 billion by 2030. Based on Baiyin's estimated output value compared with Gansu's estimated output value per employee per industry sector, the industry can support 23,400 (by 2020) and 66,300 (by 2030) direct employees in Baiyin. Cumulative new employment generated is 7,200 people by 2020 and 8,500 employees by 2030 within LIP.

59. **Estimated Land Use Demand.** At the moment, the average employee per hectare at LIP is average 10 persons per hectare. Other non-ferrous metals parks assessed including Chengzhou Diamond Tungsten Products Company, Aluminum Processing Company, and Aluminum Alloy Wheel Company indicate a much higher parameter ranging from 100 to 200

employees per hectare. For LIP, it is estimated that there will be approximately 40-50 employees per hectare. The demand for 2020 is 180 hectares and for 2030 is 220 hectares.

Coal Chemical Industry

60. **New coal chemical industry is vigorously advocated by the government as an industry of strategic importance.** The national energy structure is "much coal, little oil and gas shortage". Reduced dependence on foreign oil and national energy security is receiving much attention. International oil price instability and drop in domestic coal market prices suggests reviewing the benefits of the coal chemical industry. Current national policy strongly supports the development of new coal chemical industry, particularly in the energy-rich Western Region. And the development of new coal chemical industry is encouraged further with Gansu Province's coal chemical industry.

61. **Baiyin Municipality, as an important energy and chemical industry base in Gansu Province shows strong advantage in the development of the coal chemical industry.** The industry requires large coal resources, water, and electricity and transportation requirements. The park's land conditions, energy, electricity and water can meet the production requirements of coal chemical enterprises. The arid and semi-arid continental climate can minimize the production pollution on the environment. The natural gas and oil pipelines can facilitate transporting coal and natural gas products to the Eastern Region. Rail and road access can also facilitate the transportation of solid coal chemical products. LIP is planning to develop coal chemical industry and is introducing Xinjiang Guanghui Group, specialized in coal gasification project.

62. According to the analysis of technology maturity, market prospect and economic benefit of each coal chemical product and the national industrial policies, it is recommended that LIP will focus on the advanced coal chemical products, such as coal gasification, coal-based substitute natural gas (SNG), coal-based ethylene glycol and its derivatives, coal-based olefins (aromatics) and its derivatives, coal-to-liquid (CTL) and comprehensive utilization of waste resources.

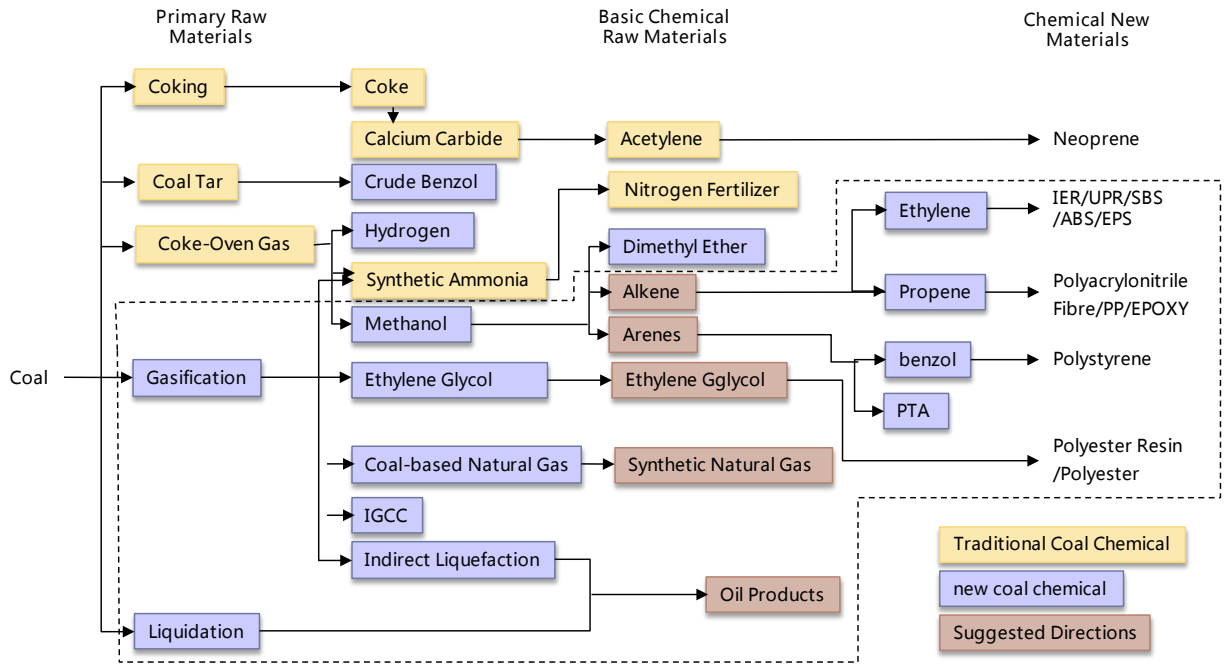


Figure 15: Recommended Coal Chemical Products

63. **Socioeconomic Impact.** The output value of coal chemical industry for Baiyin is estimated to be CNY48 billion by 2020 and CNY161.2 billion by 2030. Based on Baiyin's estimated output value compared with Gansu's estimated output value per employee for this industry, the industry can support 51,000 (by 2020) and 182,300 (by 2030) direct employees in Baiyin. Cumulative new employment generated will be 16,200 by 2020 and 33,200 employees by 2030.

Equipment Manufacturing Industry

64. **Background**. Equipment manufacturing industry is the key cultivated industry under Gansu provincial government policy of "strong industrial province". Although the equipment manufacturing industry in Gansu Province takes up a relatively small proportion in the country (with the introduction of the State Council's Opinions on Accelerating the Revitalization of the Equipment Manufacturing Industry and Gansu Province's Action Plan on the Revitalization of the Equipment Manufacturing Industry), the development of the equipment manufacturing industry is not only in line with national industrial policy, but also conforms to the trend of industrialization.

65. **Existing Conditions.** There is an opportunity for LIP to develop automotive parts manufacturing. The trend of developing automobile industries in the coastal areas is moving westward. This is a platform to develop the park's equipment manufacturing industry. While the Eastern Region's market is saturated, the demand for cars in the Western Region's market is promising. And the huge market needs can support an equally large after-market services industry. The Western Region can become the focus of enterprises' competition in the auto parts production and circulation. Since there is a production base of the finished automotive, LIP can introduce enterprises from the Eastern Region to develop and provide supporting parts for it.

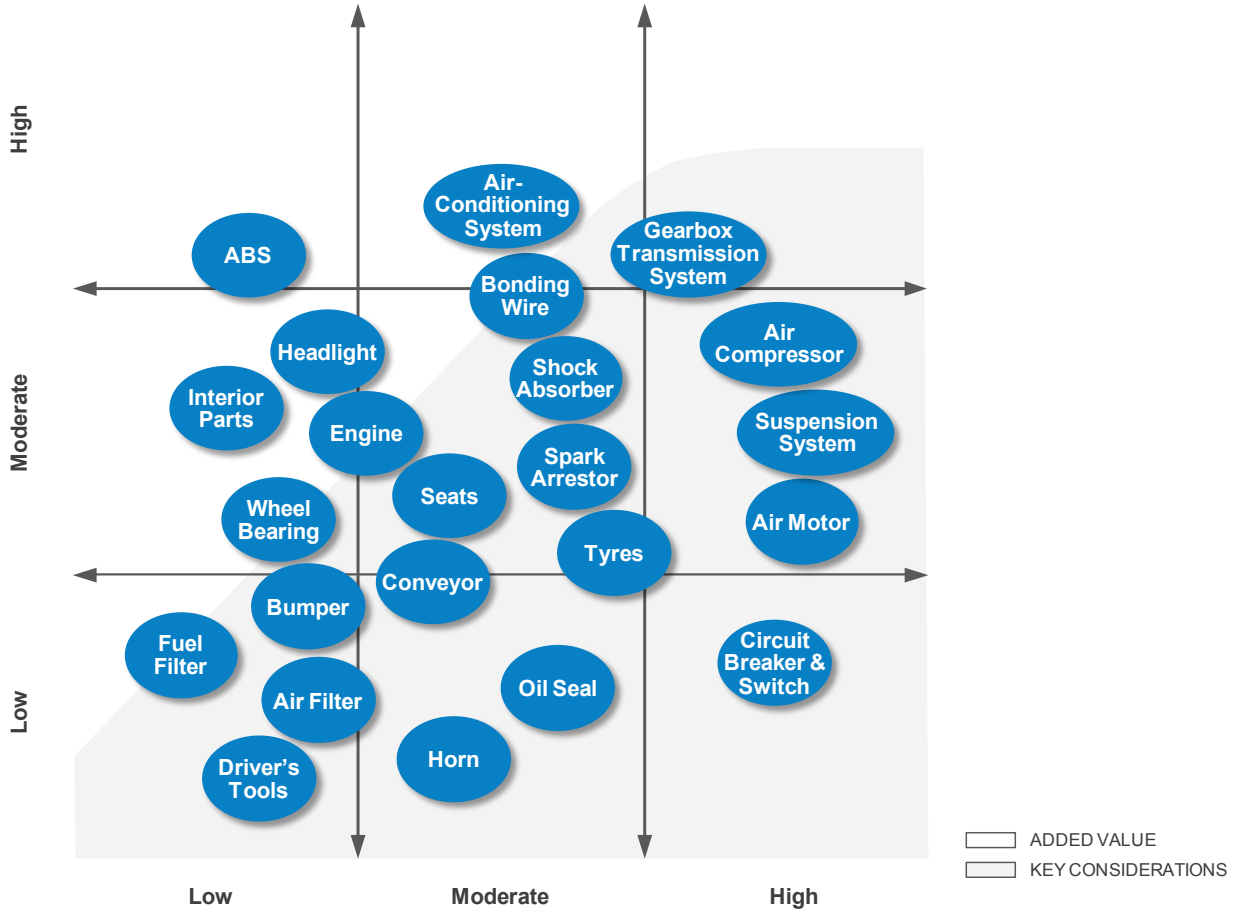


Figure 16: Recommended Automotive Parts Manufacturing Products

66. **There is a potential to develop all kinds of equipment in Baiyin. There is also a potential to develop new energy equipment manufacture, particularly wind power equipment.** Gansu Provincial Government proposed the concept of promoting wind energy and solar energy resources' advantage, and is considering the development of the Hexi Wind Power Corridor and reconstruction of the 'Three Gorges on Land'. New energy equipment manufacturing industry can be the highlight in the new energy industry chain. The Guidance on the Development of Gansu's New Energy Equipment Manufacturing Industry proposes the construction of Lanbai (Lanzhou-Baiyin) as the industrialization base of a 'wind-power machine'. LIP can develop wind blades, tower, control systems, gearbox and other key components to provide ancillary products for Lanzhou's complete machinery industry.

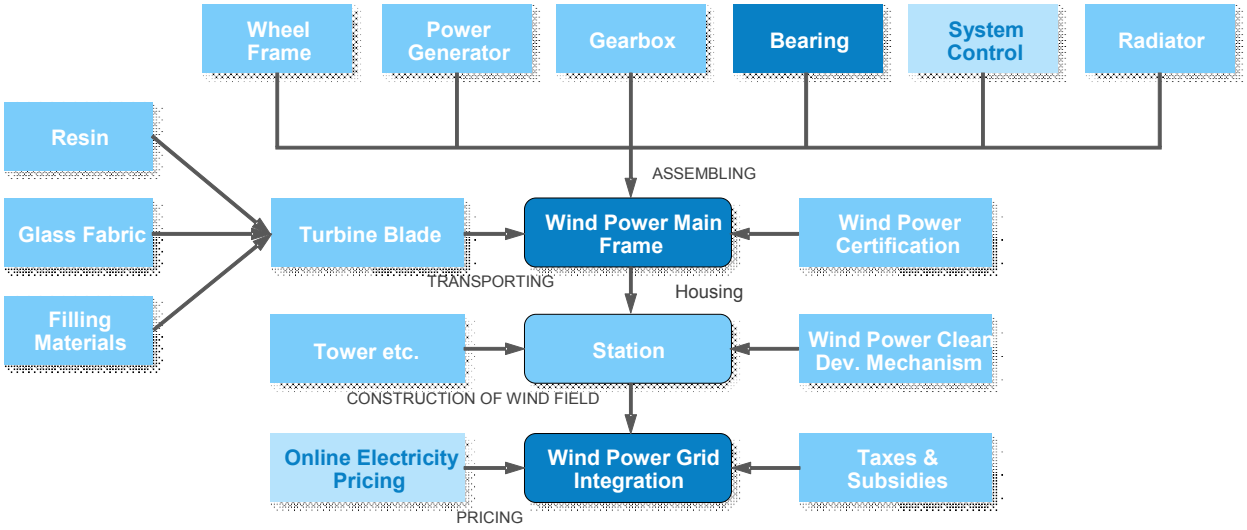


Figure 17: Recommended New Energy Equipment Manufacturing Products

67. **Socioeconomic Impact.** The output value of all kinds of equipment manufacturing industry for Baiyin is estimated to be CNY5.4 billion by 2020 and CNY29.7 billion by 2030. Based on Baiyin's estimated output value compared with Gansu's estimated output value per employee for this industry sector, the industry can support 3,500 (by 2020) and 13,600 (by 2030) direct employees in Baiyin. Cumulative new employment generated is 1,100 by 2020 and 2,600 by 2030 within LIP.

Estimated Land Use Demand

Utilities Production

68. **Overview.** Considering the full development of LIP into a 50 square kilometer park, the facility will require a huge amount of water and power.

69. **Existing Condition.** Liuchuan Industrial Park's 2020 water demand is estimated at 59,300 cubic meters per day. Total water and power requirements are estimated to increase over time.

70. **Socioeconomic Impact.** Using only value of output from the production and supply of water, the production and supply of electric power and heat which in 2011 is valued at CNY8.5 billion and the potential for waste resources and materials recycling and processing, the estimated output value for these industries – considered as utilities production – is estimated.

71. The output value for these utilities related industries for Baiyin is estimated to be CNY28.6 billion (2020) and CNY93.8 billion (2030). Based on Baiyin's estimated output value

compared with Gansu's estimated output value per employee for this industry sector, the industry can support 14,200 (by 2020) and 46,800 (by 2030) direct employees in Baiyin. Cumulative new employment generated is 4,300 by 2020 and 8,500 by 2030 within LIP.

Estimated Land Use Demand

High Quality Processing of Bases and Materials

72. **Overview.** The National Development and Reform Commission (NDRC) and Ministry of Commerce (MOC) have released a catalogue of priority industries for Central and Western China. The catalogue is the basis of applicable policies for guiding the examination and approval of foreign investment projects and enterprises.

73. **Existing Conditions.** Jingyuan has rich agricultural products, and a fruit and vegetable cold-chain logistics center has been built in LIP.

74. For Gansu the production of fruits, vegetables and flower seeds as well as the cultivation and processing of high quality beer raw materials are two priorities.

75. **Socioeconomic Impact.** The output value for these industries is estimated to be CNY6.1 billion (by 2020) and CNY24.3 billion (by 2030). Based on Baiyin's estimated output value compared with Gansu's estimated output value per employee for this industry sector, the industry can support 3,000 (by 2020) and 11,200 (by 2030) direct employees in Baiyin. Cumulative new employment generated is 4,300 by 2020 and 8,500 by 2030 within LIP.

Estimated Land Use Demand

Warehousing and Logistics Service Based Industries

76. **Overview.** The key industrial and mining enterprises in the Park are mostly running with heavy reliance on non-local markets for material procurement and product sales and, as a result, the logistics process involves "heavy load of inbound and outbound transportation". The warehousing and logistics sector in Baiyin is underdeveloped and unable to meet the needs of the new park. If the enterprises are to undertake the heavy load of transportation alone, a huge burden will be imposed on the enterprises in terms of both the construction cost in the early stage and the later production and operation cost, thus restricting the industrial development of the Park as a whole. Therefore, it is extremely necessary to develop a professional warehousing and logistics park in the Park.

77. The Park has a huge demand for warehousing and logistics service. With limited or no local resources, the raw materials needed for production of rare earth, non-ferrous metal, chemical, mechanical and cable and wire products mostly need to be transported from Xinjiang, Inner Mongolia or overseas while almost all the products produced by the large enterprises are sold to non-local markets. Jingyuan County, where the Park is located, is a large agricultural county with rich resources of agricultural products and more than 60% of its cash crop products also need logistics service for export to non-local market.

78. In Baiyin, the warehousing and logistics sector is underdeveloped and the warehousing space is seriously inadequate. As a result, it becomes difficult to transport urban consumables into the city and many large commodities, such as furniture, construction materials, automobiles, etc., have to be ordered first before transportation and the psychological needs of the consumers for comparison, selection and procurement of goods cannot be satisfied, resulting in the loss of consumers to Lanzhou, etc. Different from the traditional industrial enterprises that built their own warehouses, new enterprises are founded based on modern concepts and unwilling to invest heavily in building their own warehouses. As a result, local warehousing facilities are in serious shortage, which further leads to the underdevelopment of logistics

service. Currently, the total logistics volume of a year achieved by the professional logistics enterprises in Baiyin is less than 5% of the total of the City as a whole. Such a weak logistics capacity has seriously affected the normal operation of the national and even international logistics networks.

79. **Existing Conditions.** The Park's location advantages and transportation conditions provide a possibility for the Park to develop a trade and logistics center for industrial products, agricultural products and consumer products radiating the local region. Located in the triangle of Gansu, Qinghai and Ningxia, the Park has the location advantage of interconnecting five provinces in Northwest China and radiating a population of 68 million. With Lanzhou-Baotou High-speed Railway station (for both passenger and freight transportation), Baiyin-Baojishan Railway, G6 expressway, National Highway 109 and new and old Provincial Highway 207 in or near the Park, the Park is located 100 km away from Lanzhou Zhongchuan Airport and has the favorable conditions for construction of a large logistics center and trade market. The Park is currently negotiating with Shanghai Zhongjin Investment and Development (Group) Company about the project of automobile logistics park to drive the prosperity of local automobile and real estate market and accelerate the growth of the urban economy.

Table 7: Automotive Logistics Park in LIP

	Land Area (km^2)	Employment (persons)
Shanghai Zhongjin Automotive Logistics Park	2	5,000

Feedback from Current LIP Industry Locators

80. Interviews were conducted with industrial operators to determine expected land requirements, employment opportunities and expected economic value creation over time. Feedback from interviews includes both current and future expansion plans. Using interview results a basis, the average expected demand for land, employment opportunities up to 2030 as well as other factors were projected. This approached can be considered an alternate check to results produced by the prior industrial demand approach.

81. In terms of key assumptions, it is assumed that by 2020, projects within the 23.2 km^2 Phase 1 will be completed. Additionally, from 2020 to 2030, projects within the 52 km^2 area of the park will be completed and operational.

82. In this approach, land use and employment level is largely based on data provided by the park. Production value and tax data are calculated based on land use and employment level of projects in the park and in reference to comparable parks across the PRC. The time frame for the development of projects in the park is determined based on the "Schematic Diagram of Projects in Liuchuan Industrial Park", which has been provided by the park. And finally, the Rare Earth Company is not included in the land use calculation for the rare earth industry for 2020 but included for 2030. It should be noted that industrial land use and warehousing land use are net land use areas only and excludes land areas for roads and landscaping.

Table 8: LIP Employment and Land Use

Industries	Year	Land Area (km^2)	Output Value (CNY 100 million)	Tax (CNY 100 million)	Employment (persons)
Rare Earth and New Material	2020	1.7 [D]	4.0	0.2	14,530
	2030	5.7 [A]	13.6 [C]	0.6 [C]	49,060 [B]
Non-Ferrous Metal Processing [E]	2020	3.0 [F]	228.0	22.8	4,355 [H]
	2030 [G]	5.3	396.0	39.6	7,564
Coal Chemical	2020	3.1 [I]	80.8 [J]	14.4	10,000 [I]
	2030	3.1	80.8 [J]	14.4	10,000

Equipment Manufacturing	2020	0.2 [K]	9.8	1.0 [L]	530 [L]
	2030	4.3	213.8 [M]	31.6 [M]	5,530
Building Ceramics	2020	1.8 [O]	59.6	6.0	7,965 [O]
	2030	1.8 [P]	59.6 [Q]	6.0	7,965 [Q]
Thermal Power Plant	2020	0	0	0	0
	2030	1.0 [S]	55.0 [I]	5.5 [U]	5,000 [R]
Warehousing and Logistics	2020	[V]			
	2030	1.0 [W]			

Notes:

[A] Land use area data from 2030 is the sum of the land use areas of the New Material Industrial Park to be built and the existing Rare Earth Company.

[B] The employment population for 2020 and 2030 is sourced from data provided in the "Human Resource Needs of Enterprises in Liuchuan".

[C] Production value, profit and tax and employment population for 2030 are calculated against the percentage of land use increase, based on information from the Rare Earth Company.

[D] Land use data for 2020 is an estimated value accounting for half the land area of the Rare Earth Material Industrial Park.

[E] Half of the land used for non-ferrous metal projects is located on the land parcels for long-term development according to the "Schematic Diagram of Projects to be Settled in Liuchuan Industrial Cluster Zone" submitted to ADB.

[F] Land use area data for 2020 is the land area of "Hongtai Aluminum" in the 23 km^2 scope as shown in the "Schematic Diagram".

[G] Data for 2030 equals to the sum of the data for "Hongtai Aluminum" and "Hualu Aluminum".

[H] Employment data for 2020 equals the calculation of the employment data for 2030 based on the land use percentage.

[I] Land use area and employment population for 2020 and 2030 is the data of the identified projects.

[J] Production value per land area for 2020 and 2030 is calculated by multiplying the identified land use area by the data for the "Standard for Selection of Coal Chemical Industry Indicators" worked out from Qinghua Case Study.

[K] Land use area and employment population for 2020 is the data of Lantong Cable while that for 2030 is the data of Lantong Cable and Concentrated Solar Power Equipment Industrial Park.

[L] Profit and tax and employment data for 2020 is projected based on the case study of (Lanzhou Jinchuan Electric Wire and Cable Co., Ltd.) while the production value is assumed to be 10 times of the profit and tax.

[M] Production value and profit and tax data for 2030 is the sum of data for 2020 plus the data of the additional 4.08 km^2 as projected.

[N] The production value and employment data for the 4.08 km^2 area is estimated against the land use percentage based on the corresponding data in the case study (of Kaifeng Automobile Parts Industrial Park).

[O] Land use and employment data for 2020 and 2030 equals the sum of the data of the 3 identified projects in the "Existing Data" page.

[P] Land use data for 2030 is estimated data; the 2 to 3 km^2 architectural ceramics industry park has a commonly seen scope and it is assumed that the architectural ceramics industry park will grow by 1 km^2 in 2030.

[Q] Production value and employment population per land area for 2030 is determined on the basis of 2020 data against the growth rate of land use scope.

[R] "Human Resource Needs of Enterprises in Liuchuan Industrial Park"

[S] "Schematic Diagram of Projects to be Settled in Liuchuan Industrial Cluster Zone" submitted to ADB.

[T] Production value equals annual electricity generation capacity (11 billion kWh – Case Study: Huarun Haifeng Power Plant) multiplying the electricity price (CNY0.50/kWh – Notes of Interview).

[U] Profit and tax equals 10% of the production value.

[V] Land use area for 2020 is the result of that of the identified project plus the warehousing and logistics services provided to the Park. According to experiences, the logistics parks mostly have a land use area of 0.5 to 1 km^2.

[W] Land use area for 2030 is constant.

[X] Employment data for 2020 and 2030 for the known projects about 7,500 workers per 100 hectares (7,500 workers per 1 sq. km; roughly 75 persons per hectare).

83. Based on the table above, total industrial employment is estimated at ~37,400 in 2020 and ~85,100 in 2030.

Case Study Analysis and Benchmarking

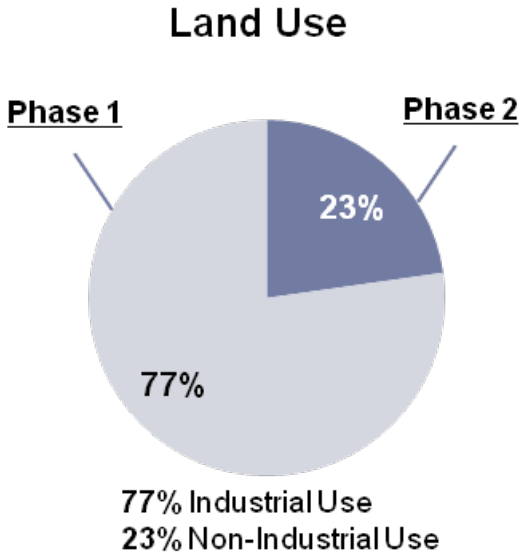
84. In this section, select domestic and international case studies are examined to derive planning parameters for service and logistics areas in support of industrial areas. These case studies also provide a context for the LIP as well as help inform best practices and emerging trends in terms of management strategy and environmental management concepts.

Domestic Case Study: Baoji High-Tech Industrial Development Zone

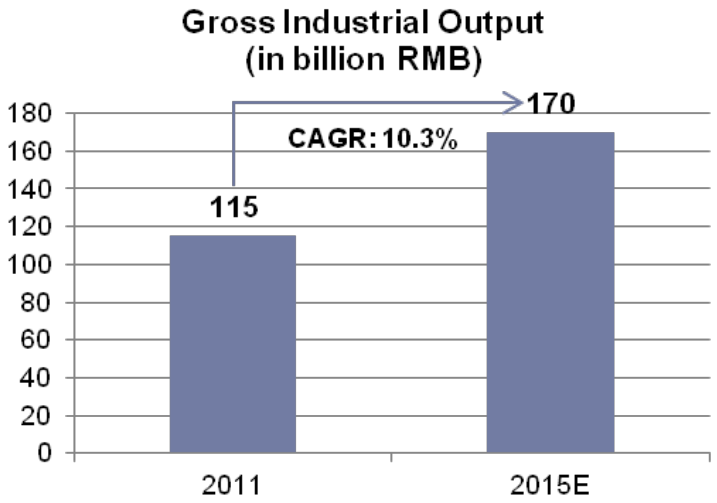
Figure 18: Baoji High-Tech Industrial Development Zone's Location

85. The Baoji Hi-Tech Industrial Development Zone (HIDZ) is one of the most successful state-level high-tech zones in the PRC. It has contributed to the development of the country's Western Region. Enterprises are attracted to the park due to its well-established infrastructure and ecological environment.

86. Baoji HIDZ's development is separated into two phases. The first phase, which consists of roughly three quarters of the development's total area at 17 square kilometers, is made up of industrial development, public facilities, green space, residential and commercial development. The second, which is mostly non-industrial use, is made up of residential and commercial use, education, public facilities, and green space.



87. From 2011 to 2015, Baoji HIDZ's gross industrial output is expected to grow at a compounded annual growth rate of 10% from CNY115 billion to CNY170 billion.



Baoji HIDZ	
Location	Baoji, Shaanxi
Year of Establishment	1992
Land Area	22 km^2 (2,200 ha)
Major Industries	Non-ferrous metals processing, machinery manufacturing, information technology, food processing
No. of Companies	3,000
Gross Industrial Output	CNY115 billion (2011) CNY170 billion (expected 2015)
Total Population	200,000

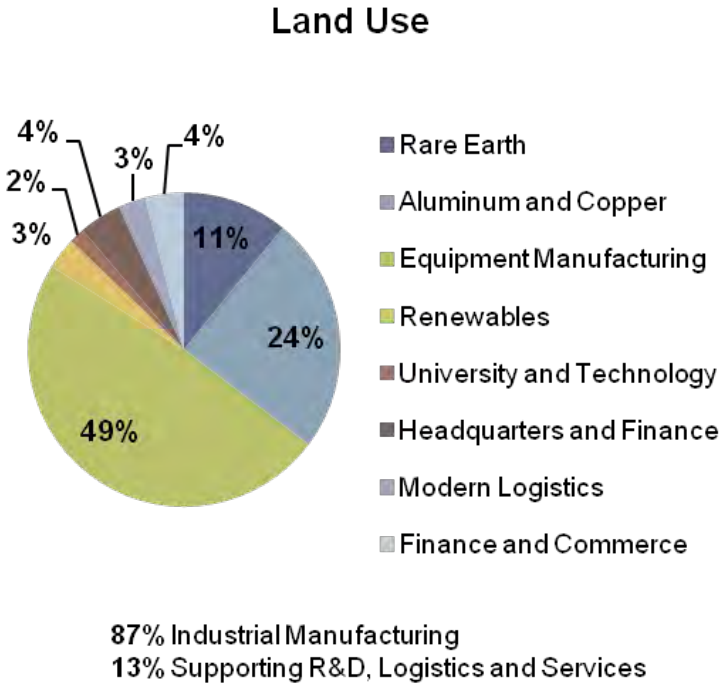
Domestic Case Study: Baotou National Rare Earth High-Tech Industrial Development Zone

Figure 19: Baotou National Rare Earth High-Tech Industrial Development Zone's Location

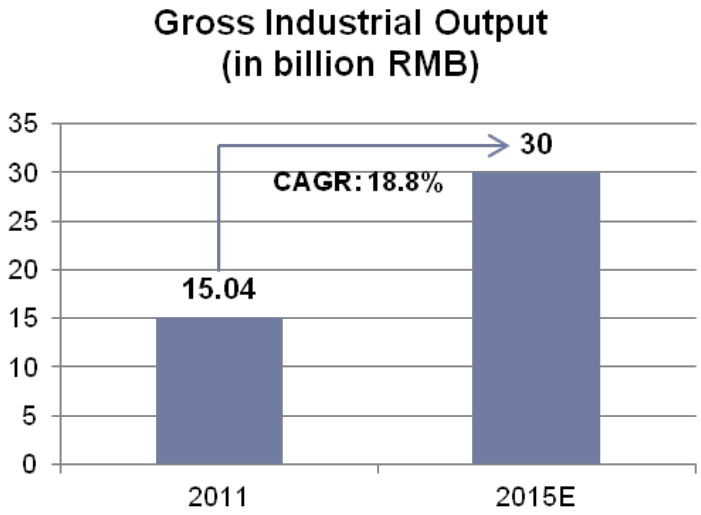
88. Baotou National Rare Earth High-Tech Industrial Development Zone (NREHTIDZ) is the only state-level high-tech zone named after the rare earth industry. Not only is Baotou the

largest rare earth industrial base in the PRC, it is also famous for its facilities for the production of iron, steel, machinery, non-ferrous materials and textiles.

89. In terms of land use, Baotou NREHTIDZ consists mostly of industrial and manufacturing uses (87%). The remaining use consists of supporting services (13%). Land apportioned to logistics in this development zone represents another 3% of industrial use land.



90. From 2011 to 2015, Baotou NREHTIDZ gross industrial output is expected to double from CNY15 billion to CNY30 billion, growing at a compounded annual growth rate of 18%.



Baotou Industrial Development Zone	
Location	Baotou, Inner Mongolia
Year of Establishment	1990
Land Area	49 km^2 (4,900 ha)

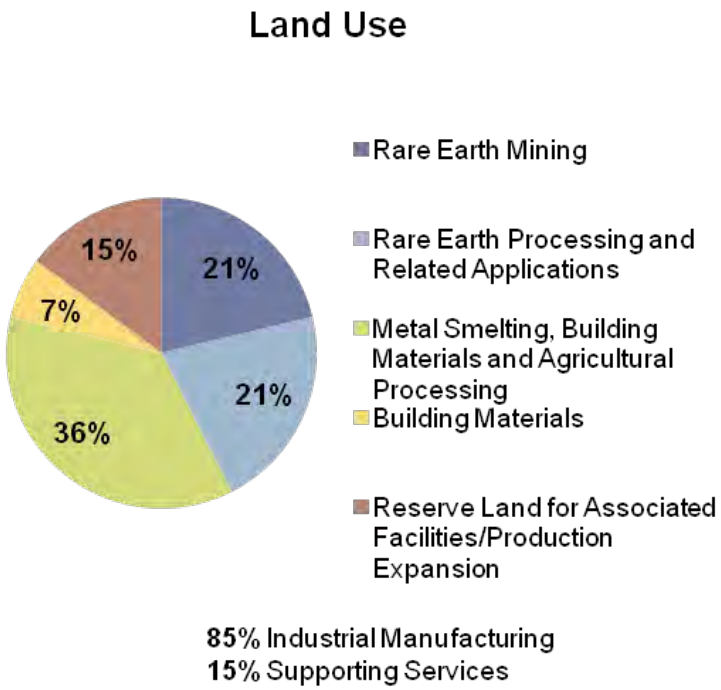
Major Industries	Rare earth metals, aluminum processing, copper smelting and processing, chemicals, motors and machinery engineering, silicon processing
No. of Companies	3,600
Gross Industrial Output	CNY15 billion (2011) CNY20 billion (expected 2015)
Total Population	125,000

Domestic Case Study: Mianning Rare Earth High-Tech Industrial Park

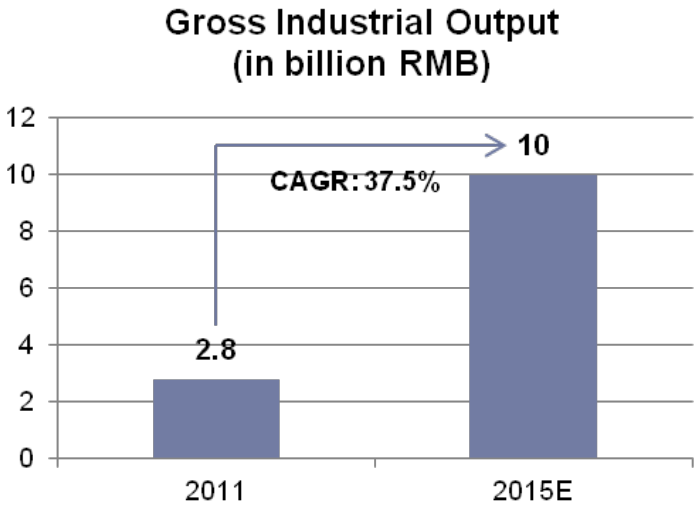
Figure 20: Mianning Rare Earth High-Tech Industrial Park's Location

91. Mianning Rare Earth High-Tech Industrial Park (REHTIP) is a newly developed industrial base located in an area rich in superior light rare earth resources. The rare earth industry is a pillar industry in Mianning County, which is well-positioned to expand production, learning and research in the field of rare earth.

92. In terms of land use, Mianning REHTIP consists mostly of industrial and manufacturing uses (85%). The remaining use consists of supporting services (15%).



93. From 2011 to 2015, Mianning REHTIP's gross industrial output is expected to grow at a rapid compounded annual growth rate of >30% from CNY2.8 billion to CNY10 billion.



Mianning Rare Earth High-Tech Industrial Park	
Location	Mianning, Sichuan
Year of Establishment	2008 (2011 first year of operations)
Land Area	23.5 km^2 (2,350 ha)
Major Industries	Rare earth metals, non-ferrous metals, building materials, agricultural products processing
Gross Industrial Output	CNY2.8 billion (2012) CNY10 billion (expected 2015) CNY30-50 billion (target for 2030)
Total Population	3,300

International Case Study: Mid America Industrial Park, Oklahoma, USA

Figure 21: Mid America Industrial Park's Location

94. Mid America Industrial Park (MAIP) is Oklahoma's largest industrial park. Of the 80 companies located within the park, seven are Fortune 500 companies.

95. **Management Strategy.** A public trust, the Oklahoma Ordinance Works Authority, governs and operates the Industrial Park. The public trust administers all services from marketing to wastewater treatment to airport operations to preventive maintenance of all park assets. Additionally, there are on-site training centers available to the companies located at the park.

96. **Environmental Management.** Offering the most competitive utility rate structure of any industrial park in the United States, the Industrial Park has on-site facilities that provide water and wastewater treatment, electricity and natural gas.

Industrial Park	
Location	Pryor Creek, Oklahoma, USA
Year of Establishment	1960
Land Area	36 km^2 (3,600 ha)
Major Industries	Chemicals, industrial gases, plastics and paper production, food processing, light manufacturing and precision machining
No. of Companies	80
Total Population	3,800
Closest Town/City	Pryor Creek
Town/City Population	9,500

International Case Study: Chempark Leverkusen, Germany

Figure 22: Chempark Leverkusen's Location

97. Chempark Leverkusen is one of three Chemparks located in North Rhine-Westphailia, Germany. Together, the three Chempark sites are responsible for a third of the province's chemical production.

98. Established in 1891, the park in Leverkusen employs over 30,000 people and contains over 70 manufacturing and service companies. Key industries at the park include chemical, pharmaceutical and high-tech. Together, they manufacture over 5,000 chemicals such as chlorination products, aromatics, fine chemicals and silicon chemicals.

99. One of the park's key competitive advantages is its convenient transport connections. The park is connected to the A1, A3 and A59 freeway. As well, the Dusseldorf and Cologne airports are both within an hour and a half drive. Finally, the park is connected with the country's rail network.

100. In addition to its convenient transport connection, since the park is located close to major Rhineland cities like Cologne and Dusseldorf, it can attract employees with a high quality of life as both cities offer international schools and multiple cultural attractions.

101. **Management Strategy.** CURRENTA is the manager and operator of Chempark Leverkusen, Dormagen and Krefeld-Uerdingen. Set up as a joint venture between Bayer AG and LANXESS AG, CURRENTA offers services such as material and energy supply, a range of analytical services and environmental management.

102. The structure of the park has been designed to promote collaboration and efficiency. For example, Kemira, a Finnish group, can use as an input hydrochloric acid, which was generated as a by-product from water chemical production.

103. In summary, new enterprises enjoy the following benefits at Chempark:

- no need to develop separate infrastructure;
- access to established networks and services;
- companies can focus on their core business;
- synergy with partner companies for improved efficiencies;
- proximity to customers;

- supply convenience as raw materials can be obtained directly from neighboring plants; and,
- expertise in waste handling and other services provided.

104. **Environmental Management.** CURRENTA Environment, CURRENTA's environment business unit, is responsible for waste disposal at Chempark Leverkusen. The unit's key philosophy involves waste avoidance as the first option, recycling of waste as a second option and the safe disposal of waste if the first two options are not possible. CURRENTA provides the following environmental management services to companies at Chempark: secure landfill for hazardous waste, hazardous waste incineration, vessel cleaning, political lobbying for environmental policies, environmental monitoring and recycling.

Chempark Leverkusen	
Location	Leverkusen, North Rhine-Westphalia, Germany
Year of Establishment	1891
Land Area	4.8 km^2 (480 ha)
Major Industries	Chemical, pharmaceutical, high-tech
No. of Companies	70
Total Population	28,000 employees
Closest Town/City	Leverkusen
Town/City Population	160,000

International Case Study: Marl Chemical Park, Germany

Figure 23: Marl Chemical Park's Location

105. Marl Chemical Park is one of the largest and most fully integrated parks in Europe. Producing over 4,000 chemicals, key companies at the park include Air Liquide, Air Products, INEOS Styrenics and Ashland. Evonik, who operates the park, also provides a range of services to companies at the park such as waste management, site security, telecommunications and facility management.

106. **Management Strategy.** Infracor GmbH, a wholly owned subsidiary of Evonik Degussa GmbH, operates Marl Chemical Park. Infracor provides a comprehensive range of services to

companies such as waste management, safety and environmental protection, security, and telecommunication.

107. The park uses a 'plug-and-play' concept, whereby new enterprises can tap into an existing comprehensive materials flow system, thereby lowering investment and operating costs.

108. **Environmental Management.** In terms of environmental management, Marl Chemical Park is building a new combined-cycle gas turbine (CCGT) power plant. Switching from coal to gas will allow the park to reduce carbon emissions by about 280,000 metric tons a year.

Marl Chemical Park	
Location	Marl, North Rhine-Westphalia, Germany
Year of Establishment	1938
Land Area	6.5 km^2 (650 ha)
Major Industries	Basic and specialty chemicals
No. of Companies	30
Total Population	3,400
Closest Town/City	Marl
Town/City Population	84,000

International Case Study: Port of Rotterdam

Figure 24: Port of Rotterdam's Location

109. Rotterdam, with access to markets all over Europe, is one of the world's major centers for oil and chemicals. The Port of Rotterdam contains the largest chemical cluster in the Netherlands with 4 major oil refineries, 40 petro-chemical companies, 3 industrial gas producers and 13 tank storage and distribution companies.

110. **Management Strategy.** The Rotterdam Port Authority, a government body, is the owner, manager and developer for the chemical cluster. It leases land and provides utilities and services.

111. The port is organized around two key principles: co-siting and co-servicing. Co-siting means location of compatible companies next to one another to maximize synergy and

efficiency. Co-servicing is the joint use of service providers such as maintenance contractors. An example is the co-siting of a chlorine cluster with an ammonia cluster.

112. **Environmental Management.** The Port Authority attempts to reduce waste by focusing on reuse. As such, they advise new companies on the most suitable locations at the port based on the residues new companies require as raw materials. Alternately, the assessment for the optimal location can be based on the type of residue the new company produces.

113. In addition to encouraging the reuse of waste, the Port Authority is also identifying renewal sources of energy such as biomass.

Port of Rotterdam	
Location	Rotterdam, Netherlands
Year of Establishment	14th century
Land Area	12 km^2 (1,200 ha)
Major Industries	Oil, gas and chemical
No. of Companies	109
Total Population	13,000
Closest Town/City	Rotterdam
Town/City Population	618,500

International Case Study: Chemical Park Delfzijl

Figure 25: Chemical Cluster Delfzijl's Location

114. The local availability of rock salt and natural gas was a key factor leading to the development of the second largest chemical cluster in the Netherlands. Today, through advanced processes, these raw materials are converted to chlorine, hydrogen, caustic soda and methanol at Chemical Park Delfzijl.

115. **Management Strategy.** Akzo Nobel operates Chemical Park Delfzijl. The main management concept is based on collaboration whereby companies exchange raw materials and share supplies.

116. **Environmental Management.** All companies at Chemical Park Delfzijl have signed the international Responsible Care program, which is a package of measures designed to preserve the environment. It covers issues such as production processes, storage, distribution and proper waste processing.

117. In addition to a commitment to Responsible Care, the park encourages a waste-to-resource strategy which aims to reduce waste and lower dependence on fossil fuels.

Chemical Park Delfzijl	
Location	Delfzijl, Groningen, Netherlands
Year of Establishment	1954
Land Area	14.7 km^2 (1,470 ha)
Major Industries	Chemical
No. of Companies	11
Total Population	1,250
Closest Town/City	Delfzijl
Town/City Population	25,700

International Case Study Summary: Logistics and Service Support for Industrial Parks

118. Having reviewed the local market demand and profiles of projects already introduced into the Park, LIP can develop a distribution system and a supportive logistics industry. Professional warehousing and logistics services are becoming an essential part of large industrial townships. Warehousing and logistics services allow industrial enterprises to create a necessary bond between production and distribution, and improve the overall investment environment of the Park. A regional platform for bulk manufactured goods can also support the local domestic economy. A modernized integrated logistics and distribution center integrating professional distribution and logistics service, including third party logistics, can serve the towns of Baiyin, Lanzhou, Gansu, and Northwest China.

119. Based on case study findings, an additional area of about 3%-5% of total industrial space can be assigned to logistics and warehousing facilities. In total, warehousing/logistics and service areas can represent 10%-15% of industrial parks with the remaining 85%-90% for industrial manufacturing.

International Case Study Summary: Management Strategy Concepts

120. International industrial parks are mostly managed by a single operator who co-sites enterprises to maximize synergies and efficiencies. In addition, the same operator will often offer a full range of services ranging from waste management to telecommunication so companies can focus on their core business.

121. The main trends in terms of management concepts for international industrial parks can be summarized as follows:

(i) *Main operator organizes structure of the park:* Industrial parks like Marl Chemical Park are managed by a single operator (Infracor GmbH). Some operators structure an efficient exchange of raw materials and sharing of manufacturing inputs.

(ii) *Co-siting used to maximize synergy and efficiency:* Industrial park operators like the Rotterdam Port Authority advises new companies on the best locations based on the waste they produce or require.

(iii) *Co-servicing companies:* In addition to co-siting, parks like the Port of Rotterdam promotes co-servicing, the joint use of service providers.

(iv) *'Plug-and-play' to attract new enterprises:* A 'plug-and-play' concept is used to attract new enterprises as they can access an existing comprehensive materials flow system designed to accommodate a select number of industries from its conception.

International Case Study Summary: Environmental Management Concepts

122. Recognizing the value of responsible environmental management concepts, international industrial parks employ a number of common strategies to minimize environmental harm while identifying ways to promote efficiencies and synergies.

(i) *Reuse of waste as raw materials:* The reuse of waste from one process as raw material for another is an increasingly common way to minimize waste creation. This reflects the concept of an Eco-Industrial Park.

(ii) *Increasing focus on renewable energy sources:* Plants have been shifting to more renewable energy sources like biomass.

(iii) *Recycling provided by park operator:* Often park operators such as CURRENTA at Chempark Leverkusen provide recycling service.

(iv) *Safe disposal of hazardous waste:* Park operations will also help enterprises dispose of hazardous waste. CURRENTA operates incineration plants and landfill sites at Chempark Leverkusen.

(v) Companies within the park sign a joint declaration towards the care and preservation of environment and work towards sustainable processes.

Industrial Demand Analysis

123. An industrial demand analysis is conducted based on the concept that the growth in value of output over time will drive industries. The following industries have been selected as priorities for LIP:

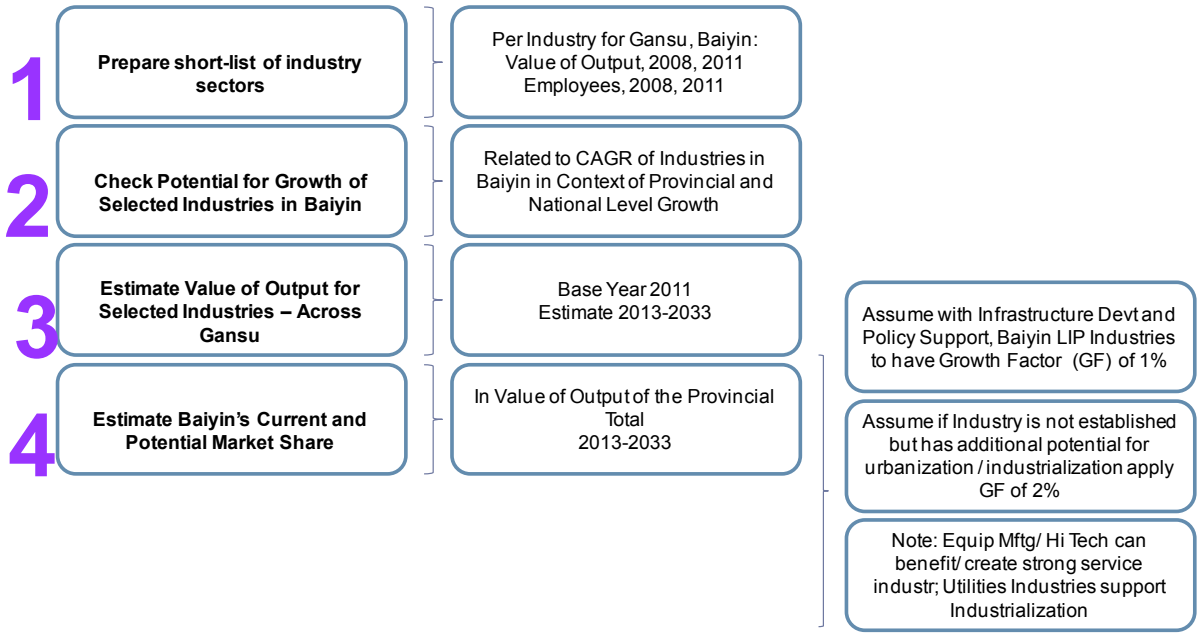
(i) Non-Ferrous Metals;
(ii) Equipment Manufacturing;
(iii) Rare Earth Products and Building Materials;
(iv) Coal Chemical and Chemical Products;
(v) High Quality Processing of Bases and Materials; and,
(vi) Utilities Production and Renewable Resources.

124. The following describes the industrial demand methodology and objectives:

(i) Ensure that there is market support for more industrial space in Baiyin and in LIP;
(ii) Measure the socioeconomic benefit of industrial driven development in Baiyin in terms of jobs and value of output;
(iii) Ensure the required types of industrial and supporting workers to support this demand;
(iv) Estimate new industrial land demand in Baiyin;
(v) Make reasonable assumption for LIP's capture of this new demand;
(vi) Estimate the size of the population working and living in LIP generated by direct industrial jobs and indirect supporting jobs; and,
(vii) Propose a long-term land use program for the entire 52 sq. km. of LIP.

125. The industrial demand assessment has three parts:

(i) **Identify the Industry Potential**. After selection of the priority industries for Baiyin, estimate of the future potential of these industries is essential. The value of output of these industries is forecast using historical growth in output value of Gansu province from 2008 to 2011 and Baiyin's share of this output in CNY.



126. Selected priority industries have upstream and downstream industries. The table of industrial sector output values have been used as a basis for creating general categories coinciding with the priority industries to collectively measure its value of output at the provincial (Gansu) and local (Baiyin level):

NON-FERROUS METALS

- Non-ferrous metals mining and dressing
- Smelting and pressing of non-ferrous metals

EQUIPMENT MANUFACTURING INDUSTRIES

- Metal Products
- General Purpose Equip Manufacturing
- Special Purpose Transport and Equipment Manufacturing
- Electric Equipment & Machinery
- Telecommunication Equipment
- Computer & Other Electronic Equipment
- Instruments, Meters, Cultural & Office Machinery
- Arts and Other Manufacturing

RARE EARTH PRODUCTS & BUILDING MATERIALS

- Non-Metal Minerals Mining and Dressing
- Non-Metal Mineral Products

COAL CHEMICAL, CHEMICAL PRODUCTS

- Coal Mining and Dressing
- Raw Chemical Materials and Chemical Products
- Medical and Pharmaceutical Products
- Chemical Fiber
- Plastic Products

HIGH QUALITY PROCESSING OF BASES AND MATERIALS

- Agriculture and Sideline Food Production
- Food Production
- Beverage Production

UTILITIES PRODUCTION, RENEWABLE RESOURCES

- Waste Resources and Materials Recycling and Processing
- Production and Supply of Water
- Production and Supply of Electric Power and Heat

127. From a look at historical growth rates of these industry sectors at the municipal, provincial and national levels, the potential of these industries to have a strong demand has been estimated. A growth factor has been applied considering the investments to be made in LIP, policy support and a higher growth factor of 2% has been applied for industries with the potential to accelerate urbanization and induce urbanization; industries that will require upstream service sector support:

	Output Value (in 10,000 CNY for Baiyin and Gansu); (in 100,000,000 CNY for China)	Baiyin 2011	Gansu 2011	Potential for Growth Provincial	Potential for Growth National	Growth Factor
	NON-FERROUS METALS					
1	Nonferrous Metals Mining and Dressing	20,864	594,500	LOW	HIGH	1.0%
2	Smelting and Pressing of Nonferrous Metals	1,559,668	9,859,581	LOW	MODERATE	1.0%
	EQUIPMENT AND HIGH-TECH INDUSTRIES MANUFACTURING					
3	Metal Products	5,005	731,913	HIGH	HIGH	2.0%
4	General Purposes Equipment Manufacturing	34,254	564,463	LOW	HIGH	2.0%
5	Equipment Manufacturing For Special Purposes	4,534	682,800	LOW	HIGH	2.0%
6	Transport Equipment Manufacturing	40,374	297,255	LOW	MODERATE	2.0%
7	Electric Equipment and Machinery	23,351	2,542,906	HIGH	MODERATE	2.0%
8	Telecommunication Equipment, Computer and Other Electronic Equipment	-	250,266	FAIR	FAIR	2.0%
9	Instruments,Meters,Cultural and Office Machinery	-	24,397	FAIR	MODERATE	2.0%
10	Arts and Other Manufacturing	-	515,252	MODERATE	HIGH	2.0%
	RARE-EARTH PRODUCTS & BUILDING MATERIALS INDUSTRY					
11	Nonmetal Minerals Mining and Dressing	4,786	154,122	FAIR	HIGH	1.0%
12	Nonmetal Mineral Products	208,237	2,070,055	MODERATE	HIGH	1.0%
	COAL-CHEMICAL, CHEMICAL PRODUCTS					
13	Coal Mining and Dressing	547,422	2,407,281	MODERATE	MODERATE	1.0%
14	Raw Chemical Materials and Chemical Products	751,436	3,171,233	FAIR	HIGH	1.0%
15	Medical and Pharmaceutical Products	20,091	623,331	FAIR	MODERATE	1.0%
16	Chemical Fiber	-	34,015	LOW	MODERATE	1.0%
17	Plastic Products	18,720	316,428	FAIR	HIGH	1.0%
	HIGH-QUALITY PROCESSING OF BASES AND MATERIALS					
18	Agriculture and Sideline Food Production	108,847	2,204,045	MODERATE	HIGH	1.0%
19	Food Production	8,232	541,076	MODERATE	MODERATE	1.0%
20	Beverage Production	21,418	1,011,612	FAIR	MODERATE	1.0%
	UTILITIES PRODUCTION/RENEWABLE RESOURCES					
21	Production and Supply of Water	2,406	76,587	LOW	MODERATE	2.0%
22	Waste Resources and Materials Recycling and Processing		18,709	FAIR	HIGH	2.0%
23	Production and Supply of Electric power and heat	842,833	6,229,751	FAIR	FAIR	2.0%
	TOTAL	**4,222,478**	**31,540,522**			

Source: Baiyin Municipality, Gansu Province, Statistical Yearbook 2009, 2012

128. By the application of CAGR to each individual sub-sector, the output value for these industries has been estimated from 2013 to 2033. The results of these estimates of total output value for Gansu are summarized in the table below (in CNY billion):

Gansu Output Value by Industry Sector	Estimated Output Value (in CNY Billions)			
Industry Sectors	**2013**	**2020**	**2030**	**2033**
Non-Ferrous Metals	126	247	457	514
Equipment Manufacturing Industry	77	273	1,147	1,584
Rare-Earth Products & Building Materials Industry	32	110	423	577
Coal Chemical Products	80	161	356	434
High-Quality Processing of Bases & Materials	48	111	288	365
Utilities Production	75	137	274	326
TOTAL	**438**	**1,039**	**2,944**	**3,800**

129. A look at the selected industry sectors and at Baiyin's current share of Gansu's total output value allows us to examine Baiyin's current market positioning and its potential to increase this share over time. Given that LIP is intended to transform Baiyin's positioning, and considering the potential of each industry, the growth / industry stimulus factor is applied here to Baiyin's current share. On top of this, inflation is also applied annually to account for the growth in the value of the industry outputs over time:

Baiyin Current and Projected Market Share of Gansu Province	Applied Industry Stimulus Factor	Market Share 2013	Market Share 2033	% Change
Non-Ferrous Metals	1.0%	16%	32%	16%
Nonferrous Metals Mining and Dressing	1.0%	4%	7%	4%
Smelting and Pressing of Nonferrous Metals	1.0%	17%	34%	16%
Equipment Manufacturing Industry	2.0%	2%	3%	1%
Rare-Earth Products & Building Materials Industry	1.0%	10%	21%	11%
Coal Chemical Products	1.0%	22%	45%	23%
High-Quality Processing of Bases & Materials	1.0%	4%	8%	4%
Utilities Production	2.0%	15%	34%	20%
Total Market Share of Baiyin		**11%**	**16%**	**5%**
Ave. Applied Industry Stimulus Factor on Selected	1.50%			
Ave. Inflation Applied Annually	1.30%			

130. Baiyin's output value by industry sector is then derived from 2013 to 2033.

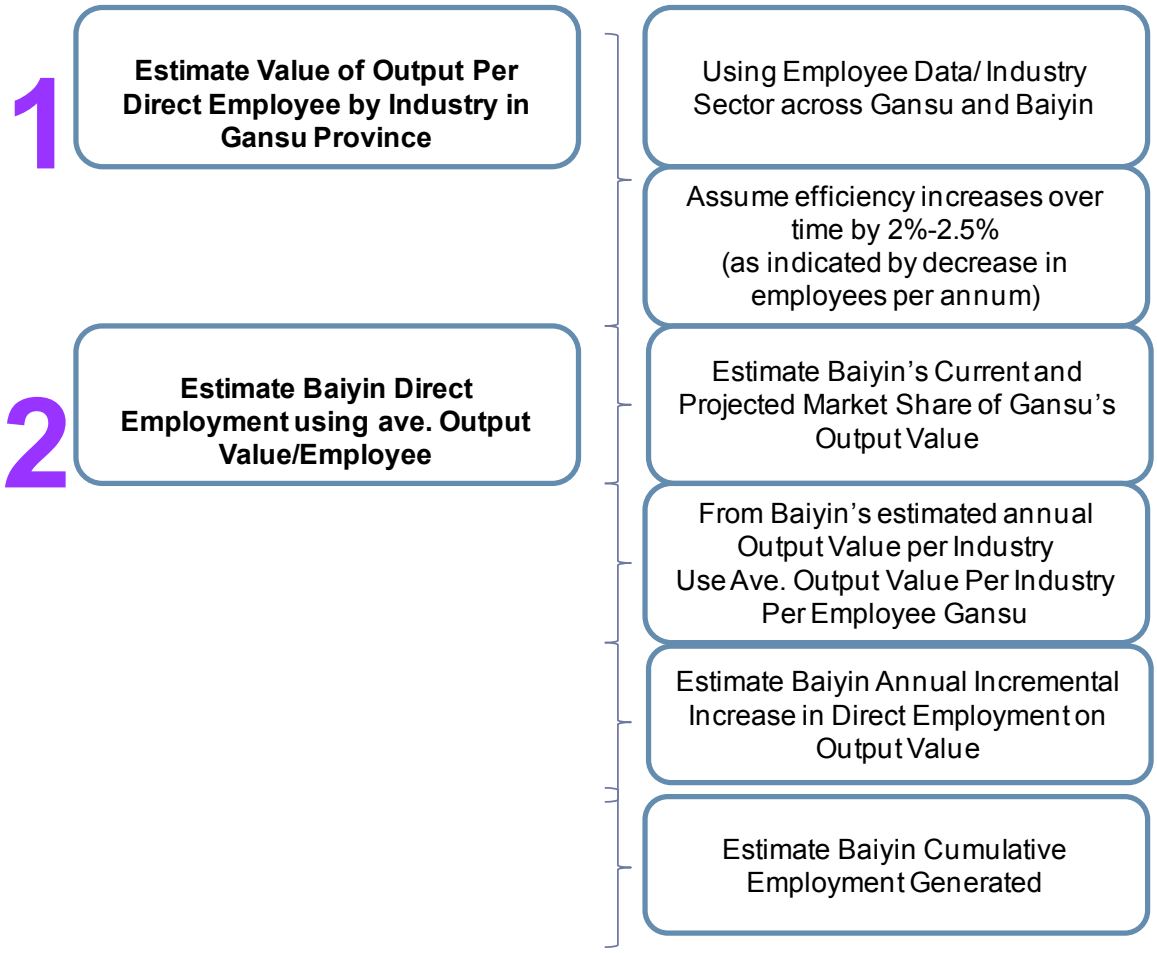
Baiyin Output Value by Industry Sector	Estimated Output Value (in CNY Millions)			
Industry Sectors	**2013**	**2020**	**2030**	**2033**
Non-Ferrous Metals	20,697	53,182	146,259	185,224
Equipment Manufacturing Industry	1,553	5,376	29,737	46,346
Rare-Earth Products & Building Materials Industry	3,308	15,494	88,836	136,716
Coal Chemical Products	17,765	48,061	161,183	222,176
High-Quality Processing of Bases and Materials	1,923	6,098	24,290	34,813
Utilities Production	11,085	28,618	93,826	129,564
TOTAL	**48,292**	**133,669**	**459,185**	**634,613**

131. Baiyin's annual incremental increase in output value per industry type or new industrial demand for these industry sectors is shown below:

Baiyin Incremental Increase in Value of Output	Estimated Output Value (in CNY Millions)			
Baiyin Municipality	**2013**	**2020**	**2030**	**2033**
Non-Ferrous Metals	2,610	6,708	11,073	14,023
Equipment Manufacturing Industry	218	964	4,036	6,411
Rare-Earth Products & Building Materials Industry	654	3,071	11,891	18,301
Coal Chemical Products	2,349	6,382	16,325	22,560
High-Quality Processing of Bases & Materials	291	929	2,746	3,936
Utilities Production	1,405	3,626	9,569	13,215
Total	**6,401**	**18,426**	**46,360**	**65,296**

(ii) **Industry Benefits –** The second part of the industrial demand assessment is the calculation of industrial benefits accompanying this demand. This primarily focuses on the numbers of new direct employment created with the demand for these industries. This measures the direct socioeconomic benefit of an industrial driven development, in this case specific to Baiyin.

132. The methodology for estimating the total socioeconomic benefit in terms of jobs and supportable population over the short-term and long-term are described in the diagram below:



133. The selected industries in Gansu Province supported a total of 550 thousand employees in 2008 and 380 thousand employees in 2011. The output value contribution of each employee can be estimated by comparing the number of employees with the total output value of the same industries.

Employment by Industry Type in Gansu Province		
Industry Sectors	2008	2011
NON-FERROUS METALS	**94,669**	**85,403**
Nonferrous Metals Mining and Dressing	15,474	8,440
Smelting and Pressing of Nonferrous Metals	79,195	76,963
EQUIPMENT MANUFACTURING INDUSTRY	**95,904**	**60,313**
Metal Products	8,417	5,632
General Purposes Equipment Manufacturing	19,842	12,331
Equipment Manufacturing For Special Purposes	23,568	13,214
Transport Equipment Manufacturing	10,074	7,662
Electric Equipment and Machinery	17,941	10,863
Telecommunication Equipment, Computer and Other Electronic Equipment	9,526	9,391
Instruments,Meters,Cultural and Office Machinery	883	739
Arts and Other Manufacturing	5,653	481
RARE-EARTH PRODUCTS & BUILDING MATERIALS INDUSTRY	**45,435**	**24,652**
Nonmetal Minerals Mining and Dressing	4,554	2,279
Nonmetal Mineral Products	40,881	22,373
COAL-CHEMICAL PRODUCTS	**168,552**	**124,866**
Coal Mining and Dressing	71,732	56,358
Raw Chemical Materials and Chemical Products	58,186	41,576
Medical and Pharmaceutical Products	12,433	5,818
Chemical Fiber	16,595	16,595
Plastic Products	9,606	4,519
HIGH-QUALITY PROCESSING OF BASES AND MATERIALS	**66,395**	**32,291**
Agriculture and Sideline Food Production	35,562	12,450
Food Production	12,211	7,825
Beverage Production	18,622	12,016
UTILITIES PRODUCTION	**81,734**	**51,402**
Production and Supply of Water	6,009	3,604
Waste Resources and Materials Recycling and Processi	1,125	460
Production and Supply of Electric power and heat	74,600	47,338
TOTAL	**552,689**	**378,927**

134. The value of output of production per direct employee in the priority industries in Gansu province is used as a parameter for estimating total direct employees in the same industries in Baiyin. Historically, the number of employees per industry is decreasing indicating an increase in operational efficiency over time. It is assumed that the operational efficiency of each industry improves over time; so the value of output per direct employee will also increase over time. For the purpose of assuming that value of output per employee increases over time, a growth of approximately 2% to 2.5% per annum is applied. This is a conservative number compared with the actual growth in output value per employee over the past 3 years from 2008 to 2011. The table below estimate the adjusted value of output per unit of production per direct employee at the provincial level:

Value of Output Per Direct Employee by Industry in Gansu Province	Estimated Output Value in 1'000 CNY Per Employee			
Industry Sector	2013	2020	2030	2033
Average for Non-Ferrous Metals	1,040	1,235	1,535	1,625
Nonferrous Metals Mining and Dressing	740	880	1,080	1,140
Smelting and Pressing of Nonferrous Metals	1,340	1,590	1,990	2,110
Average for Equipment Manufacturing Industry	2,140	2,531	3,135	3,325
Metal Products	1,360	1,610	2,010	2,130
General Purposes Equipment Manufacturing	480	550	650	680
Equipment Manufacturing For Special Purposes	540	610	740	790
Transport Equipment Manufacturing	410	480	580	610
Electric Equipment and Machinery	2,460	2,910	3,610	3,830
Telecommunication Equipment, Computer and Other Electronic Equipment	280	350	450	480
Instruments,Meters,Cultural and Office Machinery	350	420	520	550
Arts and Other Manufacturing	11,240	13,320	16,520	17,530
Average for Rare-Earth Products & Building Materials Industry	840	1,000	1,250	1,325
Nonmetal Minerals Mining and Dressing	710	850	1,050	1,110
Nonmetal Mineral Products	970	1,150	1,450	1,540
Average for Coal Chemical Products	628	740	928	1,000
Coal Mining and Dressing	450	520	620	680
Raw Chemical Materials and Chemical Products	800	940	1,190	1,280
Medical and Pharmaceutical Products	1,130	1,340	1,710	1,830
Chemical Fiber	20	20	20	20
Plastic Products	740	880	1,100	1,190
Average for High Quality Processing of Bases and Materials	1,153	1,363	1,683	1,790
Agriculture and Sideline Food Production	1,850	2,200	2,730	2,900
Food Production	730	870	1,070	1,130
Beverage Production	880	1,020	1,250	1,340
Average for Utilities Production	680	813	1,013	1,073
Production and Supply of Water	230	300	400	430
Waste Resources and Materials Recycling and Processing	430	500	600	630
Production and Supply of Electric power and heat	1,380	1,640	2,040	2,160

135. The average output value per direct employee in Gansu for the selected priority industries is used to estimate the numbers of employees in Baiyin by comparing two factors: Baiyin's annual output value against Gansu's output value per employee. As a result the total number of direct employees in Baiyin is derived for the same industry sectors. Baiyin's numbers of employees (based on their outputs) are summarized below:

Baiyin Direct Employment on Output	Baiyin No. of Direct Employees			
Industry	**2013**	**2020**	**2030**	**2033**
Non-Ferrous Metals	3,690	23,758	66,284	81,195
Equipment Manufacturing Industry	605	3,527	13,553	18,818
Rare-Earth Products & Building Materials Industry	1,220	11,655	59,930	87,580
Coal Chemical Products	7,569	51,053	182,340	238,183
High-Quality Processing of Bases and Materials	417	3,030	11,206	15,359
Utilities Production	2,211	14,207	46,791	62,703
Total Direct Employees in Selected Industries in Baiyin	**15,710**	**107,230**	**380,105**	**503,838**

136. Out of this total number, it is useful to determine the new incremental demand per year. The estimates reveal the annual demand for new employ with the development of Baiyin's industrial parks:

Baiyin Incremental Increase in Direct Employment by Industry Sector	Direct Employees (in Numbers)		
	2020	2030	2033
Non-Ferrous Metals	3,762	4,385	5,284
Equipment Manufacturing Industry	598	1,387	1,954
Rare-Earth Products and Building Materials Industry	2,436	7,125	10,403
Coal Chemical Products	8,592	17,373	20,289
High Quality Processing of Bases and Materials	535	1,160	1,515
Utilities Production/ Renewable Resources	2,260	4,419	5,790

137. The cumulative new demand for employees for the selected industries in Baiyin is summarized below:

Baiyin	Demand (in Numbers)		
Cumulative Increase in Direct Employment	**2020**	**2030**	**2033**
Non-Ferrous Metals	7,156	8,509	10,248
Equipment Manufacturing Industry	1,115	2,623	3,706
Rare-Earth Products and Building Materials Industry	4,446	13,410	19,569
Coal Chemical Products	16,209	33,188	38,850
High Quality Processing of Bases and Materials	1,003	2,208	2,884
Utilities Production/ Renewable Resources	4,298	8,462	11,079
Total Industrial Employment	**34,227**	**68,399**	**86,336**

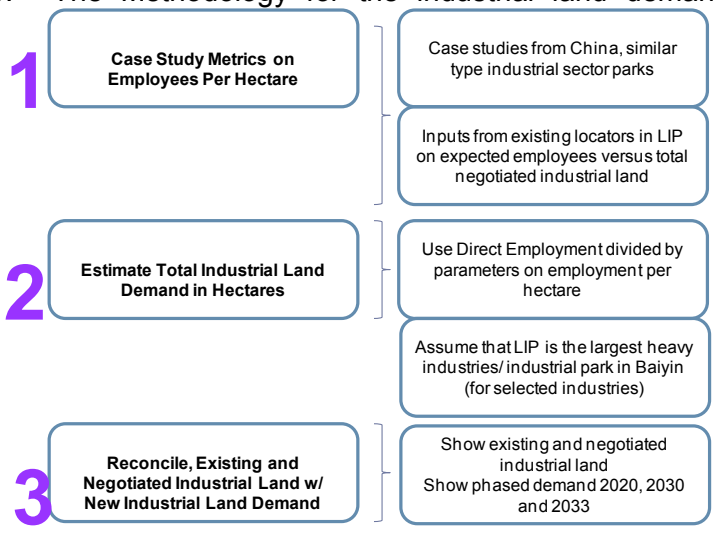
138. This demand has to be tested against the expected penetration of LIP in terms of each industry type and the number of competition (local competitive parks) for these industries. It is assumed that there is more competition for non-ferrous metals, rare earth products / new building materials, and high quality processing of bases and material (agri-based) industries. Because of this, their capture is expected to be 50%. For the equipment manufacturing industry, there will be a higher penetration as LIP is expected to allow for all kinds of equipment manufacturing industries unlike those offered in the other 5 parks + 1 park. There will be a 100% demand for coal chemical products and site specific utilities production in LIP because the former is a very novel and policy supported industry, while the latter is specific to LIP's needs.

LIP New Employee Demand Penetration by Industry	% Penetration	2020	2030	2033
Non-Ferrous Metals	50%	3,578	4,254	5,124
Equipment Manufacturing Industry	80%	892	2,098	2,965
Rare-Earth Products & Building Materials Industry	50%	2,223	6,705	9,785
Coal Chemical Products	100%	16,209	33,188	38,850
High-Quality Processing of Bases and Materials	50%	502	1,104	1,442
Utilities Production	100%	4,298	8,462	11,079
Cumulative Penetration		**27,702**	**55,812**	**69,245**

139. What this suggests is that although there is new demand for the industries in Baiyin, LIP can only capture a portion of this demand, and this is related to its ability to entice its fair share of industrial employees to LIP: estimated 28,000 industry workers in 2020 and 56,000 in 2030.

(i) Industrial Land Demand and Phasing

140. The Methodology for the industrial land demand and phasing is described below.



141. A number of benchmarks of industrial parks by industry type were reviewed in order to derive some planning parameters on employees per hectare including existing locators at the LIP and comparative industrial parks:

142. The following are a summary of metrics of total employees per hectare from existing locators at LIP and from selected benchmarks:

Summary of Planning Parameters	Ave. LIP Popn/Ha	Range of Popn / Ha	Assumed Popn/Ha
Non-Ferrous Metals	10	80-200	20
Equipment Manufacturing Industry	45	50-110	50
Rare-Earth Products and Building Materials Industry	19	40-170	20
Coal Chemical Products	20	100-120	50
High Quality Processing of Bases and Materials		25-70	25
Utilities Production/ Renewable Resources		20-40	10

143. Based on these metrics, the total industrial land demand is derived by industry sector. Logistics and warehousing as well as service areas are estimated as additional 3%-5% and 8%-10% of total industrial park development.

Industrial Land Use Requirements	LIP Locator Interview		Industrial Demand Assessment			Balance Un-accounted Demand		
	2020	2030	2020	2030	2033	2020	2030	2033
Non-Ferrous Metals	300	530	179	213	256	(121)	(317)	
Equipment Manufacturing Industry	20	430	18	42	59	(2)	(388)	
Rare-Earth Products and Building Materials Industry	350	750	111	335	489	(239)	(415)	
Coal Chemical Products	310	310	324	664	777	14	354	
High Quality Processing of Bases and Materials	-	-	20	44	58	20	44	
Utilities Production/ Renewable Resources	-	-	430	846	1,108	430	846	
Total Industrial (in Hectares)	**980**	**2,020**	**1,080**	**2,140**	**2,750**	**100**	**120**	**730**

144. This demand is factored into the whole 52 square kilometer site and its phased development across 2020, 2030 and 2033. Industrial land demand is expected to change with time but consistently >40%. And industrial, warehousing/logistics and service areas are ~50% to 60% of the total land development.

145. The total area allotted for residential development is 805 hectares starting with an initial 205 hectares in 2020.

Liuchuan Industrial Park Development Program	23 SqKm Existing Plan		Land Demand Assessment					
	2020		2020		2030		2033	
Land Use	%	Hectares	%	Hectares	%	Hectares	%	Hectares
Industrial	39%	890	47%	1,080	43%	2,140	53%	2,750
Logistics/ Warehouse (3%-5% of industrial areas)	13%	308	2%	43	2%	86	2%	110
Service Areas (8%-10% Admin, Civic, Services)	10%	219	4%	90	4%	178	4%	229
Water Bodies/Mountains	25%	575	25%	575	12%	609	12%	609
Roads and MP Parks	13%	308	13%	308	13%	670	13%	697
Expansion/Other Use Areas			9%	204	26%	1,317	15%	805
LIP Land Use Program	**100%**	**2,300**	**100%**	**2,300**	**100%**	**5,000**	**100%**	**5,200**

146. It is assumed that logistics / warehousing will have a worker population of about 40 to 50 persons per hectare and service areas (including civic, government offices, etc.) are estimated to have about 80 to 100 persons per hectare. Given these assumptions, the total daytime and night-time population can be estimated.

147. Out of the total industrial workers, it is estimated that more than 50% of employees, assumed here to be approximately 65% of total employees, will be working and living on-site with their families; where the average worker per household is 1.5 and the average household size is 3.

Population	Existing Plan (Popn.Est.)		Locator Interviews (Popn.Est.)		Land Demand Assessment (Popn. Est.)		
	2020	2030	2020	2030	2020	2030	2033
Daytime - Worker Population	**46,000**	**92,345**	**46,440**	**92,699**	**36,618**	**73,480**	**91,949**
Industrial Worker Population	38,000	79,745	37,400	78,859	27,702	55,812	69,245
Logistics/ Warehousing Worker Population	*4,000*	*4,200*	*3,040*	*3,040*	*1,728*	*3,424*	*4,400*
Service Worker Population	*4,000*	*8,400*	*6,000*	*10,800*	*7,188*	*14,244*	*18,304*
Nighttime - Resident Population					**36,012**	**72,555**	**90,018**
Industrial Workers Living On-Site (assumes 65% of industrial workers & their families live on-site)					18,006	36,278	45,009
No. of On-Site Households (assumes 1.5 workers per household)					12,004	24,185	30,006
Total Nighttime Population (assumes average household size of 3)					36,012	72,555	90,018

148. The estimated population size for LIP is between 36,000 and 39,000 in 2020, between 73,000 and 79,000 in 2030 and about 90,000-98,000 at full development – during the night time or daytime.

Supplementary Documents

People's Republic of China: Gansu Baiyin Integrated Urban Development Project

TA No. 8381 – PRC

AECOM Asia Company Limited

June 2015

SUPPLEMENTARY DOCUMENTS

1. Detailed Cost Estimates and Financing Plan
2. Financial Management Assessment
3. Technical Analysis
   A – Water Supply Subcomponent
   B – Wastewater Subcomponent
   C – Road Subcomponent
   D – ITS Component
4. Poverty and Social Analysis
5. Social Development Action Plan
6. Public Private Partnership
7. Capacity development activities conducted in PPTA

SUPPLEMENTARY DOCUMENT 1
DETAILED COST ESTIMATES AND FINANCING PLAN

1. This section describes the project cost estimates, cost categories and components to be financed by the ADB, the Baiyin Municipal Government (BMG), the Jingyuan County Government (JCG), and the Industrial and Commercial Bank of China (ICBC) (Baiyin) and the Bank of Gansu.

2. The loan proceeds will be disbursed according to ADB *Loan Disbursement Handbook* (2007, as amended from time to time), subject to provisions of the final loan agreement.

A. Summary Cost Estimates

3. The project investment cost is estimated at $212.66 million, including taxes and duties amounting to $10 million. The total amount includes physical and price contingencies, and financing charges during implementation, including commitment charges. **Table 1** presents the summary project investment plan.

Table 1: Project Investment Plan
($ Million)

Item	(CNY Million) Foreign Currency	Local Currency	Total Cost	($ Million) Foreign Currency	Local Currency	Total Cost
A. Investment Cost						
1. Civil Works	65	636	702	10.70	104.32	115.02
2. Mechanical and Equipment	87	88	175	14.29	14.37	28.65
3. TVET	7	8	15	1.21	1.29	2.50
4. Land Acquisition	-	87	87	-	14.18	**14.18**
5. Survey, Design and Supervision	-	48	48	-	7.86	**7.86**
6. Consultants	3	8	11	0.47	1.35	**1.82**
a. Project Management	2	6	8	0.33	1.05	**1.39**
b. Capacity Development	1	2	3	0.14	0.30	0.43
Sub-total (A)	**155**	**867**	**1,022**	**25.45**	**142.08**	**167.53**
B. Contingencies	-	-	-			
1. Physical	16	87	102	2.55	14.21	16.75
2. Price	8	111	119	1.33	18.25	19.57
Sub-total (B)	**24**	**198**	**222**	**3.87**	**32.46**	**36.33**
C. Financing Charges During Implementation	-	-	-			
1. Interest During Construction	19	32	51	3.11	5.31	8.42
2. Commitment Fees	2	-	2	0.38	-	0.38
Sub-total (C)	**21**	**32**	**54**	**3.49**	**5.31**	**8.80**
Total Project Cost (A+B+C)	**200**	**1,097**	**1,297**	**32.81**	**179.85**	**212.66**

ITS = intelligent transport system, LIP = Liuchuan Industrial Park, TVET = technical and vocational education and training
Source: TA Consultants

4. The Government has requested a loan of $100 million from ADB's ordinary capital resources (OCR) to help finance the project. The loan will have a 25-year term, a 5-year grace period, an annual interest rate determined in accordance with ADB's 5-year London Interbank Offered Rate (LIBOR) based lending facility, a commitment charge of 0.15% per annum and other such terms and conditions as set forth in the draft loan and project agreements.

5. The Government has requested that repayment will follow the annuity method with a 10% discount rate option. Based on these terms, the repayment option and the repayment dates, the average loan maturity is at 18.31 years. The maturity premium payable to ADB is at 20 basis points (0.2%) per annum. ADB Controllers will provide final confirmation of amounts and will issue the amortization schedule during loan negotiations.

B. Summary Financing Plan

6. The loan will finance 47% of the project cost, including civil works, equipment and capacity development and institutional strengthening. The loan will also finance taxes and duties for ADB financed eligible expenditures, including bank charges, freight and insurance costs. The Government has provided ADB with (i) the reasons for deciding to borrow under ADB LIBOR-based lending facility on the basis of these terms and conditions, and (ii) an undertaking that these choices were its own independent decision and not made in reliance on any communication or advice from ADB. BMG will provide counterpart funding equivalent to $79.88 million or 38% of total project cost. Loan funds from ICBC and Bank of Gansu will provide the balance of $32.79 million or 15%. **Table 2** presents the tentative project financing plan with details given as attachments to this section.

Table 2: Financing Plan

Financier	CNY Million	$ Million	%Total
Asian Development Bank	609.98	100.00	47.0%
Baiyin Municipal Government	487.27	79.88	37.6%
Industrial and Commercial Bank of China	99.98	16.39	7.7%
Bank of Gansu	99.98	16.39	7.7%
Total Cost	**1,297.20**	**212.66**	**100%**

Source: TA Consultants

7. The People's Republic of China (PRC) will be the borrower of the loan. PRC will relend the entire amount to Gansu Provincial Government (GPG), which will onlend the loan proceeds to BMG on the same terms and conditions as those of the ADB loan. BMG, as the end borrower, will assume the foreign exchange risks for the ADB loan. BMG will enter into a project implementation agreement with the Jingyuan County Government to implement the water supply, sanitation and road subcomponents in the Liuchuan Industrial Park (LIP). BMG will enter into an implementation agreement with the Public Security Bureau and the Traffic Police Brigade to implement the traffic management system. BMG will also enter into an implementation agreement with the technological institutes identified to implement the technical and vocational education part of the capacity building and institutional strengthening components of the project.

Attachment A: Detailed Cost Estimates by Expenditure Category

Item	(CNY Million) Foreign Currency	Local Currency	Total Cost	($ Million) Foreign Currency	Local Currency	Total Cost	% of Total Base Cost	% of Total Cost
A. Investment Cost								
1. Civil Works	65	636	702	10.70	104.32	115.02	69%	54%
2. Mechanical and Equipment	87	88	175	14.29	14.37	28.65	17%	13%
3. TVET	7	8	15	1.21	1.29	2.50	1%	1%
4. Land Acquisition	-	87	87	-	14.18	**14.18**	8%	7%
5. Survey, Design and Supervision	-	48	48	-	7.86	**7.86**	5%	4%
6. Consultants	3	8	11	0.47	1.35	**1.82**	1%	1%
a. Project Management	2	6	8	0.33	1.05	**1.39**	1%	1%
b. Capacity Development	1	2	3	0.14	0.30	0.43	0%	0%
Sub-total (A)	**155**	**867**	**1,022**	**25.45**	**142.08**	**167.53**	**100%**	**79%**
B. Contingencies	-	-	-					
1. Physical	16	87	102	2.55	14.21	16.75	10%	8%
2. Price	8	111	119	1.33	18.25	19.57	12%	9%
Sub-total (B)	**24**	**198**	**222**	**3.87**	**32.46**	**36.33**	**22%**	**17%**
C. Financing Charges During Implementation	-	-	-					
1. Interest During Construction	19	32	51	3.11	5.31	8.42	5%	4%
2. Commitment Fees	2	-	2	0.38	-	0.38	0%	0%
Sub-total (C)	**21**	**32**	**54**	**3.49**	**5.31**	**8.80**	**5%**	**4%**
Total Project Cost (A+B+C)	**200**	**1,097**	**1,297**	**32.81**	**179.85**	**212.66**	**127%**	**100%**

ITS = intelligent transport system, TVET = technical and vocational education and training, WW = wastewater

Attachment B: Detailed Cost Estimates by Financier

Item	Total Cost [a]	ADB		BMG		ICBC		Bank of Gansu	
		Amount	% Cost Category	Amount	% Cost Category	Amount	% Cost Category	Amount	% Cost Category
A. Investment Cost [b]									
1. Civil Works	115.02	66.04	62	16.19	8	16.39	15%	16.39	15%
2. Equipment	26.15	26.15	100	0.00	0	0.00	0%	0.00	0%
3. TVET	2.50	2.50	100	0.00	0	0.00	0%	0.00	0%
4. Land Acquisition and Resettlement	14.18	0.00	0	14.18	100	0.00	0%	0.00	0%
5. Survey, Design and Supervision	7.86	0.00	0	7.86	100	0.00	0%	0.00	0%
6. Consultants									
a. Project Management	1.39	1.39	100	0.00	0	0.00	0%	0.00	0%
b. Capacity Development	0.43	0.43	100	0.00	0	0.00	0%	0.00	0%
Sub-total (A)	**167.53**	**96.51**	**58**	**38.24**	**22**	**16.39**	**10%**	**16.39**	**10%**
B. Contingencies [c]									
1. Physical	16.75	0.00	0	16.75	100	0.00	0	0.00	0
2. Price	19.57	0.00	0	19.57	100	0.00	0	0.00	0
Sub-total (B)	**36.33**	**0.00**	**0**	**36.33**	**100**	**0.00**	**0**	**0.00**	**0**
C. Financing Charges During Implementation [d]									
1. Interest During Construction	8.42	3.11	37	5.31	63	0.00	0	0.00	0
2. Commitment Fees	0.38	0.38	100	0.00	0	0.00	0	0.00	0
Sub-total (C)	**8.80**	**3.49**	**40**	**5.31**	**60**	**0.00**	**0**	**0.00**	**0**
Total Project Cost (A+B+C)	**212.66**	**100.00**	**48**	**79.88**	**36**	**16.39**	**8**	**16.39**	**8**

ICBC =Industrial and Commercial bank of China; ITS = intelligent transport system; TVET = technical and vocational education and training

Note: Numbers may not sum precisely because of rounding.

[a] Includes taxes and duties of $10.0 million to be financed from government and Asian Development Bank (ADB) loan resources.

[b] In March-2014 prices

[c] Physical contingencies are computed at 10% for works and goods. Price contingencies are computed using domestic inflation rates: 2.7% for 2014, 3.0% for 2015 onwards; and foreign inflation rates: 2.3% for 2014, 1.0% for 2015, and 1.4% for 2016 onwards. Excluding contingencies for the land acquisition and resettlement cost which is already included in the base cost.

[d] Includes interest and commitment charges. Interest during construction for the ADB loan has been computed at the 5-year US dollar fixed swap rate plus a spread of 0.50% and a maturity premium of 0.20%. Commitment charges for an ADB loan are 0.15% per year to be charged on the undisbursed loan amount. Interest during construction for the domestic bank loans has been computed at the domestic rates of 7.20% per annum for the Industrial and Commercial Bank of China, and 6.7% per annum for the Bank of Gansu.

Source: TA Consultants' estimates

Attachment C: Detailed Cost Estimates by Output

($ Million)

Item	Total Cost [a]	Liuchuan Industrial Park Infrastructure Development		Intelligent Transport Systems Installation		Technical and Vocational Education and Training Enhancement	
		Amount	% Cost Category	Amount	% Cost Category	Amount	% Cost Category
A. Investment Cost [b]							
1. Civil Works	115.02	115.02	100	0.00	0	0.00	0
2. Equipment	26.15	20.94	80	5.21	20	0.00	0
3. TVET	2.50	0.00	0	0.00	0	2.50	100
4. Land Acquisition	14.18	14.18	100	0.00	0	0.00	0
5. Survey, Design and Supervision	7.86	7.49	95	0.37	5	0.00	0
6. Consultants							
a. Project Management	1.39	1.13	82	0.25	18	0.00	0
b. Capacity Development, External Resettlement and Social Monitor	0.43	0.43	100	0.00	0	0.00	0
Sub-total (A)	**167.53**	**159.20**	**95**	**5.83**	**3**	**2.50**	**2**
B. Contingencies [c]							
1. Physical	16.75	15.91	95	0.59	4	0.25	1
2. Price	19.57	18.87	96	0.26	1	0.44	3
Sub-total (B)	**36.33**	**34.79**	**96**	**0.86**	**2**	**0.68**	**2**
C. Financing Charges During Implementation [d]							
1. Interest During Construction	8.42	8.00	95	0.30	4	0.12	1
2. Commitment Fees	0.38	0.36	95	0.01	3	0.01	2
Sub-total (C)	**8.80**	**8.36**	**95**	**0.31**	**4**	**0.13**	**1**
Total Project Cost (A+B+C)	**212.66**	**202.33**	**95**	**7.00**	**3**	**3.32**	**2**

ITS = intelligent transport system, TVET = technical and vocational education and training, WW = wastewater
Note: Numbers may not sum precisely because of rounding.
[a] Includes taxes and duties of $10.0 million to be financed from government and Asian Development Bank (ADB) loan resources.
[b] In March-2014 prices
[c] Physical contingencies are computed at 10% for works and goods. Price contingencies are computed using domestic inflation rates: 2.7% for 2014, 3.0% for 2015 onwards; and foreign inflation rates: 2.3% for 2014, 1.0% for 2015, and 1.4% for 2016 onwards. Excluding contingencies for the land acquisition and resettlement cost which is already included in the base cost.
[d] Includes interest and commitment charges. Interest during construction for the ADB loan has been computed at the 5-year US dollar fixed swap rate plus a spread of 0.50% and a maturity premium of 0.20%. Commitment charges for an ADB loan are 0.15% per year to be charged on the undisbursed loan amount. Interest during construction for the domestic bank loan has been computed at the domestic rates of 7.2% per annum for the Industrial and Commercial Bank of China, and 6.7% per annum for the Bank of Gansu.
Source: TA Consultants' estimates

Attachment D: Detailed Estimates by Year

Item	Total Cost [a]	2014	2015	2016	2017	2018	2019	2020
		($ Million)						
A. Investment Cost [b]								
1. Civil Works	115.02	1.61	5.35	17.44	22.46	27.49	32.32	8.34
2. Equipment	26.15	0.00	2.08	6.23	4.67	5.70	3.20	4.27
3. TVET	2.50	0.00	0.25	0.38	0.50	0.50	0.63	0.25
4. Land Acquisition	14.18	0.00	7.09	4.25	2.84	0.00	0.00	0.00
5. Survey, Design and Supervision	7.86	0.00	0.76	1.14	1.80	1.88	1.88	0.40
6. Consultants								
a. Project Management	1.39	0.00	0.25	0.27	0.27	0.27	0.27	0.07
b. Capacity Development	0.43	0.00	0.00	0.09	0.11	0.11	0.11	0.02
Sub-total (A)	**167.53**	**1.61**	**15.79**	**29.80**	**32.65**	**35.95**	**38.40**	**13.25**
B. Contingencies [c]								
1. Physical	16.75	0.16	1.58	2.98	3.26	3.59	3.84	1.33
2. Price	19.57	0.19	1.84	3.48	3.81	4.20	4.49	1.56
Sub-total (B)	**36.33**	**0.35**	**3.42**	**6.46**	**7.08**	**7.80**	**8.33**	**2.89**
C. Financing Charges During Implementation [d]	0.00							
1. Interest During Construction	8.42	0.00	2.38	1.68	1.15	1.34	1.28	0.60
2. Commitment Fees	0.38	0.00	0.15	0.13	0.07	0.02	0.01	0.00
Sub-total (C)	**8.80**	**0.00**	**2.53**	**1.81**	**1.22**	**1.36**	**1.28**	**0.60**
Total Project Cost (A+B+C)	**212.66**	**1.95**	**21.74**	**38.07**	**40.95**	**45.10**	**48.01**	**16.84**
%Total Project Cost	**100**	**1**	**10**	**18**	**19**	**21**	**23**	**8**

ITS = intelligent transport system, TVET = technical and vocational education and training; WW = wastewater

[a] Includes taxes and duties of $10.0 million to be financed from government and Asian Development Bank (ADB) loan resources.

[b] In March 2014 prices.

[c] Physical contingencies are computed at 10% for works and goods. Price contingencies are computed using domestic inflation rates: 2.7% for 2014, 3.0% for 2015 onwards; and foreign inflation rates: 2.3% for 2014, 1.0% for 2015, and 1.4% for 2016 onwards. Excluding contingencies for the land acquisition and resettlement cost which is already included in the base cost.

[d] Includes interest and commitment charges. Interest during construction for the ADB loan has been computed at the 5-year US dollar fixed swap rate plus a spread of 0.50% and a maturity premium of 0.20%. Commitment charges for an ADB loan are 0.15% per year to be charged on the undisbursed loan amount. Interest during construction for the domestic bank loan has been computed at the domestic rates of 7.2% per annum for the Industrial and Commercial Bank of China, and 6.7% per annum for the Bank of Gansu.

Source: TA Consultants' estimates

SUPPLEMENTARY DOCUMENT 2
FINANCIAL MANAGEMENT ASSESSMENT

1. Introduction

1. The Financial Management Assessment (FMA) of the proposed Gansu Baiyin Integrated Urban Development Project was carried out in accordance with Asian Development Bank (ADB)'s Guidelines for the *Financial Management and Analysis of Projects*[1] and the publication *Financial Due Diligence: a Methodology Note*[2], to assess the financing management capacity of the Baiyin Municipal Government (BMG) and the three implementing agencies (IAs) – Liuchuan Industrial Park Management Committee (LMC) (a government department), Baiyin Public Transport Company (BPT) (a state-owned organization), and Jingyuan County Bureau of Human Resources and Social Security (JHRSS) (a government department). The Baiyin Traffic Police Bureau (TPD) is a part of BMG and financially dependent upon the BMG.

2. The FMA includes review of the funds-flow arrangements, staffing, accounting policies and procedures, internal and external auditing arrangements, reporting and monitoring, and financial information systems. The instrument used for the assessment was ADB's financial management assessment questionnaire (FMAQ). Based on the FMA findings, a risk assessment was also conducted rating the overall sufficiency and preparedness of the IAs to undertake project financial tasks.

3. This assessment was prepared during the TA preparation in January to April 2014, and may need to be updated to reflect subsequent developments and agreements. Preparation activities included reviewing documents, interviewing counterparts and consultants, and discussing issues with stakeholders.

2. Legal Status and Organizational Structure

4. The IAs are government departments and state-owned companies. The organizational structures of the IAs are basically appropriate for the Project. None of the IAs have implemented any foreign-funded project. However, BMG through Baiyin project management office (PMO) has implemented an ADB financed project – Baiyin Urban Development Project.

3. Funds Flow Arrangements

5. The ADB loan will go through the Ministry of Finance (MOF), Gansu Provincial Government Finance Bureau (GPFD), and Baiyin Municipal Government Finance Bureau.

6. Each IA will open a separate account exclusively for the Project which will serve as the delegation of control and responsibility as required for ADB loan disbursement. No IA has previous experience in the management of loan disbursements from ADB. However, BMG has implemented the ADB financed Baiyin Urban Development Project. The counterpart funds will be ensured by local government revenue and some will be sourced from domestic borrowings and paid through bank account transfer.

4. Accounting Department and Accounting Staff

7. The existing accounting departments and accounting staff of the IAs are effective for the current organizations.

8. The accounting departments usually have at least three accounting positions: head of the division, accountant, and cashier. The accounting staff in the IAs has enough experience in

[1] ADB. 2005. *Financial Management and Analysis of Projects*.
[2] ADB. 2009. *Financial Due Diligence A Methodology Note*.

government accounting and receives appropriate accounting training for at least one week a year. All accounting staff will be trained in ADB disbursement procedures. Since the IAs are either government departments and/or state-owned organizations, the accounting staff is not frequently transferred, and turnover is low. There are detailed job descriptions and regulations on the accounting positions, such as head of the department, accountant, and cashier in all IAs.

9. The staff numbers are adequate for current day-to-day activities. For new project requirements, staff will need to be complemented and will need specific training to comply with ADB guidelines for project fiscal management and reporting.

5. Accounting Standards and Policies

10. All IAs follow the Chinese Government (Administrative) Accounting Standards and Accounting Systems, which are issued and updated by Ministry of Finance. The IAs also need to follow the accounting policies and regulations related to the accounting standards that guide the current government accounting activities.

6. Accounting Procedures

11. All IAs are found to have sufficient working budget and accounting systems.

12. The current accounting procedures are adequate to the IAs. The accounting procedures such as transaction recording, chart of accounts, controls, and cost allocations are well established and are effective. The general ledger and subsidiary ledgers are always reconciled and in balance.

13. Based on the accounting regulations in the PRC all accounting and supporting documents are kept for 15 years and financial statements are retained on a permanent basis.

14. The functions related to authorization of transaction, recording and custody of assets are well separated. Similarly, the functions related to ordering, receiving, accounting for, and paying for goods and services are also separated based on the current accounting regulations. The Municipal and County Governments have the power to determine the amount of payroll and the change of payroll.

7. Asset Management

15. All IAs maintain detailed records of cash receipts and expenditures. The head of the organization (usually represented by Head of the accounting department) is the person who authorizes the payments. As a common practice, the cashier reconciles banks and cash every month.

16. All IAs maintain a good system to protect the assets from fraud, waste and abuse. Physical inventory of fixed assets is usually conducted at the end of each year. The IAs do not normally purchase insurance for their assets except for vehicles.

8. Budgeting System

17. All IAs maintain a well-established budgeting system, which is characterized by office expenditure budget. The normal procedures for budgeting are: (i) the accounting staff establishes the budget at the end of the year based on historical performance; (ii) the accounting staff submits the budget to the Human Resource Department, Municipal/County Government; (iii) the budget is then submitted to Finance Bureau, Municipal/County Government; and (iv) the budget is effective once Finance Bureau, Municipal/County Government, approves it. The budget normally contains only financial indicators except for special expenditure and contains enough details of the IAs' business. Any variation in a budget

requires approval before or after the variation. Actual performances are usually compared to the budget at the end of the year and are used as a base for future budgeting.

9. Auditing system

18. All IAs, except for the LMC, maintain an internal auditing system.

19. Independent auditing firms and state and local government offices perform external audit on the IAs. The auditing reports are usually released in 45 days after audit is completed. The audit is conducted based on the national standards on auditing issued by the central government. No major accountability issue has been found in the audit reports in the past years.

10. Financial Reporting

20. Consistent with the organizational structure, the IAs prepare balance sheets, revenue and expenditure statements, total revenue statements, total expenditure statements, detailed revenue statements, detailed expenditure statements, payroll statements, and office expenditure statements monthly and annually. They also prepare fixed asset statements and basic information at the end of each year. The current reporting system is effective for the existing organizations. At the end of each year, the IAs finalize the financial statements and compare them with the physical data and budget.

11. Information System

21. The information systems in all IAs are computerized rendering the IAs to provide statutory reports on time. All financial statements are produced from the automated accounting systems using spreadsheet applications. Under the project, there will be need to upgrade to standardize and link reports to a main network at PMO to enhance real-time reporting and internal control.

12. Conclusions and Recommendations

22. Based on the analysis above, the current organizational structures of the IAs are appropriate to the existing organization and the Project. The fund flow arrangements are clearly defined. The current accounting standards, policies, procedures, asset management, budgeting, auditing, reporting, and accounting system of the IAs are effective for the existing organizations.

23. Summary of findings:

- None of the IAs have been involved in a foreign funded loan project.
- GPFD, which will operate and administer the imprest account, has extensive experience in administering ADB and other foreign-financed projects.
- BMG has implemented an ADB financed project.
- The Chinese Government Accounting Standard, and related policies, regulations, and procedures currently adopted by the IAs, are suitable to the Project.
- BMG and all the IAs strictly follow the established accounting and financial management policies and procedures in the PRC.
- The staff numbers in the IAs are adequate for current day-to-day activities.

24. It is, therefore, recommended that:

- All IAs will include the required counterpart funds in their budget. The budget for the Project should cover detailed cost items and physical indicators for the Project.
- Understanding of and adherence to ADB's financial management policies and procedures and strengthened internal audit system will be enhanced during the project implementation.
- BMG, LMC and JHRSS will maintain a separate project account in line with PRC's

accounting standards, which will be subject to independent external audit by qualified commercial or government auditors.

- Baiyin PMO and all the IAs will finalize organizational arrangements; set up clear institutional arrangements and strengthen coordination mechanism; complete staff recruitment to fill identified positions; undertake more training, particularly on ADB policy and procedures; and seek external financial management assistance as needed, before the Project is implemented.

13. Summary Risk Assessment

25. The level of risk to financier/investor in terms of IA capacity to manage finances has been evaluated, based on the following risk rating:

- Low risk – finance personnel have appropriate educational background, knowledge about funding arrangements of externally financed projects, and experience particularly in ADB procedures; accounting systems and policies and audit procedures are updated and follow national and international standards; and reporting and information systems are automated and integrated/linked and regularly maintained.
- Moderate risk – finance personnel have appropriate background and experience but require specific training in ADB procedures; accounting and audit follow national and international standards but systems need updating; and reporting and information systems are partially automated, not integrated and require updating and maintenance.
- Substantial risk – personnel have limited educational background and work experience in externally financed projects and require training in ADB procedures and information systems; accounting systems partially comply with international standards although reflect conformance with national reporting systems; national audit requirements are complied with but lack internal auditing; and information and reporting systems are only partially automated.
- High risk – personnel have limited background and experience in externally financed projects and require extensive training in funds management; accounting systems and internal and external audit procedures do not conform to international standards; and reporting and information systems are not automated.

26. The review finds that the IAs generally satisfy ADB minimum financial management requirements for IAs, and have sufficient financial management capability to (i) record required financial transactions and balances, (ii) provide regular and reliable financial statements and monitoring reports, (iii) safeguard the financial assets, and (iv) subject required financial documents to auditing arrangements acceptable to ADB and MOF. Overall, the FMA rates the IAs to be low to moderate risk. Table 1 presents the results of the risk assessment.

Table 1: Risk Assessment

Particulars	Rating	Conclusions
A. Implementing Agencies	Moderate	IAs are either government organizations or state-owned companies. Organizational structures are appropriate to undertake the project. Except for BMG, none had previous experience implementing foreign-assisted projects.
B. Fund Flow Arrangements	Low	BMG is experienced in managing/implementing ADB loan under Gansu Baiyin Urban Development Project. ADB project loan will flow from MOF through Gansu Provincial Government Finance Bureau (GPFD), and Baiyin Municipal Government Finance Bureau. MOF and IAs will open exclusive bank accounts for project transactions, including counterpart funds from local governments and from domestic borrowings.
C. Staffing	Low	IAs are sufficiently staffed with experienced personnel for their current day-to-day obligations. Staff undergo refresher training annually. Project required accountants and finance staff will be selected in accordance with the ADB Guidelines and trained accordingly.
D. Accounting	Low	Accounting policies are based on PRC accounting standards and

Particulars	Rating	Conclusions
Standards and Policies, Budgeting and Assets Safeguard		provide for commercial and accrual-based systems. Accounting and financial procedures manual is available to the accounting department and staff; updated MOF circulars are issued. Budgeting practices are satisfactory, with actual performance reviewed each year end to compare with approved appropriations and used as basis for future financial planning. Internal control systems are in place to protect against fraud, waste and abuse. The project will ensure all procedures continue to satisfy MOF and ADB requirements.
E. Internal Audit	Low	Except for the LMC, the IAs have an established internal audit unit that abides by PRC audit guidelines. The Jingyuan County Audit Office audits LMC.
F. External Audit	Low	Independent external auditors, the Government Audit Office under MOF, and State Audit Office at the local government level, audit each IA on annual basis. The audit is done in accordance with international standards of auditing (ISA) and complies. The project will ensure IA compliance with audit requirements of ADB and MOF.
G. Reporting and Monitoring	Moderate	IAs prepare financial reports consistent with organizational needs and comply with MOF periodic requirements on a timely basis. TPD and BPT accounting systems automatically generate reports. BMG, LMC and JHRSS manually prepare reports and transfer these onto spread sheet application. Project staff will be trained on computerized reporting software.
H. Information Systems	Moderate	The information systems in the IAs, except in the TPD and JHRSS, are computerized. The systems installed are able to produce required financial reports. Staff are not trained in systems maintenance. Under the project, a linked information network will ensure effectiveness of the information exchange.

Source: TA Consultants

Table 2: Financial management assessment questionnaire of Baiyin Municipal Finance Bureau

Background Information	
Name of Organization	Baiyin Municipal Finance Bureau
Component for which the organization is responsible	Whole project
Name of individual completing this questionnaire	LUO Huaijun

Topic	Response
1. Implementing Agency / Executing Agency	
1.1. What is your organization's legal status / registration?	01391127-6
1.2. Has your organization implemented a foreign-financed project in the past? (If yes, provide detailed project name)	Not implemented alone. Provided only finance and loan reimbursement services for foreign funded projects.
1.3. What is your organization's governing body?	Baiyin Municipal Government (BMG)
1.4. What is the governing body's relationship to the Government?	Superior-subordinate relationship
1.5. What are the legal financial reporting requirements for your organization?	Prepare financial reports in accordance with the requirements for administrative institutions of the People's Republic of China's (PRC's) financial system
1.6. Is the organizational structure appropriate for the needs of the project?	Partly satisfy
2. Funds Flow Arrangement	
2.1. Describe project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government, and other financing sources.	Loan money – appropriate financial departments at all levels – to project implementation agency
2.2. Are arrangements to transfer the proceeds of the ADB loan from the Finance Bureau to your organization satisfactory?	Yes
2.3. In the past, what have been the major problems in the receipt of ADB funds?	Loan payment is too slow

2.4. In which bank will the Imprest Account be opened?	Decided by the superior financial department
2.5. Do the project Implementing Agencies have experience in the management of disbursements from ADB?	Yes
2.6. Does your organization have experience managing foreign exchange risks?	No
2.7. Is your organization responsible for providing counterpart funds?	Yes
2.8. What will be the counterpart sources of funds for your subcomponent construction?	Financial income funds
2.9. How are counterpart funds accessed?	Payment after collection by the government
2.10. How will tariffs be used to help fund the project?	Yes
2.11. Are beneficiaries required to contribute to project costs?	Not necessarily
2.12. If the beneficiaries have an option to contribute in kind are proper guidelines formulated to record and value the contribution?	Yes
2.13. How are payments made from counterpart funds?	Direct payment
3. Staffing	
3.1. What is your organization's structure for accounting or finance department? (Attach an organization chart.)	Bureau of finance – finance section – accountant – teller
3.2. Identify accounting staff. (Include name, position title, responsibilities, educational background, and professional certification)	Song Xueqin – Finance director – Accounting – Accounting professional. OUYANG Li - Finance department's cashier – professional cashier personnel
3.3. If the ADB loan is approved, what staffing changes will you make to assist with project finance and accounting?	Relevant personnel of the department in charge receive pre-service training before taking responsibility of the work; when necessary, recruit new staff with knowledge of the work
3.4. Is the accounting function adequately staffed?	Yes
3.5. Is the accounting staff adequately qualified and experienced?	Yes
3.6. Are finance and accounting staffs trained in ADB procedures?	Trained
3.7. Does the organization have written position descriptions, which clearly define duties, responsibilities, lines of supervision, and limits of authority for all officers, managers, and staff?	Yes
3.8. What is the existing training policy for the accounting staff?	Continuing education and pre-service training
4. Accounting Policies and Procedures	
General	
4.1. Does the organization have an accounting system, which allows for proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective subcomponents, disbursement categories, and source of funds?	Yes
4.2. What organization's accounting system will the Implementing Agency and Executing Agency use?	International financial organizations' loan management documents and information compiled (Baiyin Municipal Finance Bureau)
4.3. Are controls in place concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained?	Yes
4.4. Is the chart of accounts adequate to properly account for and report on project activities and disbursements categories?	Yes
4.5. Are cost allocations to the various funding sources made accurately and in accordance with established agreements?	Yes
4.6. Are the general ledger and subsidiary ledgers reconciled and in balance?	Balance and consistent
4.7. Are all accounting and supporting documents retained on a	Can keep for a long time

permanent basis in a defined system which allows authorized users easy access?	
Segregation of Duties	
4.8. Are the following functional responsibilities performed by different units or persons:	
4.8.1. Authorize transactions	Yes
4.8.2. Record transactions	Yes
4.8.3. Maintain custody of assets involved in transaction	Yes
4.9. Are the functions for ordering, receiving, accounting for goods and services segregated?	Yes
4.10. Are bank reconciliations prepared by someone other than those who make or approve payments?	Yes
Budgeting System	
4.11. Do budgets include physical and financial targets?	Yes
4.12. Are budgets prepared for all significant activities in sufficient detail to provide a meaningful tool with which to monitor subsequent performance?	Yes
4.13. Are actual expenditures compared with the budget with reasonable frequency, and explanations required for significant variations from the budget?	Yes
4.14. Are approvals for variations from budget required in advance?	Yes
4.15. Who is responsible for preparation and approval of budgets?	The budget department
4.16. How are budgets prepared and approved?	Budget law
4.17. Are procedures in place to plan project activities, collect information from the units in charge of different projects, and prepare budgets?	Yes
4.18. Are the project plans and budgets of project activities realistic, based on valid assumptions, and developed by knowledgeable individuals?	Yes
Payments	
4.19. Do invoicing processing procedures provide for:	
4.19.1. Copies of purchase orders and receiving reports be obtained directly from issuing departments?	Yes
4.19.2. Comparison of invoice quantities, prices, and terms with those indicated on the purchase order and with records of goods actually received?	Yes
4.19.3. Comparison of invoice quantities with those indicated on the receiving report?	Yes
4.19.4. Checking accuracy of calculations?	Yes
4.20. Are all invoices:	
4.20.1. Stamped PAID?	Yes
4.20.2. Dated?	Yes
4.20.3. Reviewed and approved?	Yes
4.20.4. Marked for account code assignment?	Yes
4.21. What controls exist for the preparation of payroll?	Prepare according to the approved manpower in the institutional setup and personal qualifications
4.22. How are changes to the payroll authorized?	To the personnel department for examination and approval
Policies and Procedures	
4.23. What is the basis of accounting (e.g. cash or accrual)?	Accrual accounting
4.24. What accounting standards are followed?	Administrative institution's accounting system
4.25. Does the organization have adequate policies and procedures manual to guide activities and ensure staff accountability?	Yes
4.26. Is the accounting policy and procedure manual updated for project activities?	Yes

4.27. Do procedures exist to ensure that only authorized persons can alter or establish a new accounting principle, policy, or procedure to be used by the organization?	Yes
4.28. Are written policies and procedures covering all routine financial management and related administrative activities?	Yes
4.29. Do policies and procedures clearly define conflict of interest and related party transactions (real and apparent) and provide safeguards to protect the organization?	Accounting law
4.30. Are manuals distributed to appropriate personnel?	Yes
Cash and banking	
4.31. Indicate names and positions of authorized signatories of the bank accounts.	
4.32. Does the organization maintain an adequate up-to-date cashbook, recording receipts and payments?	Yes
4.33. What controls exist for the following activities:	
4.33.1. Collection of revenues?	Handled by a specially-assigned person
4.33.2. Timely deposit of receipts?	Yes
4.33.3. Recording of receipts at each collection location?	Yes
4.34. Are bank statements and cashbook reconciled on a monthly basis?	Yes
4.35. Are unusual items on the bank reconciliation reviewed and approved by a responsible officer?	Yes
4.36. How quickly are receipts deposited?	On the same day
Safeguarding Assets	
4.37. Describe the system to record assets and protect them from fraud, waste, and abuse?	The state-owned assets management system
4.38. Are subsidiary records of fixed assets and stocks kept up to date?	Yes
4.39. Are subsidiary records of assets and stocks reconciled to control accounts?	Yes
4.40. How frequent are physical inventories of fixed assets and stocks?	Once a year (if necessary, at any time)
4.41. Are assets covered by insurance policies?	Some parts are covered.
Other Offices and Implementing Agencies	
4.42. Are there other implementing agencies participating in implementation?	Yes
4.43. Has the Project Management Office (PMO) established controls and procedures for flow of funds, financial information, accountability, and audits in relation to other offices or implementing agencies?	Yes
4.44. Does information among different implementing agencies flow in an accurate and timely fashion?	Yes
4.45. Are periodic reconciliations of financial information performed among the different implementing agencies?	Yes
Other	
4.46. Has the PMO advised employees to whom to report if they suspect fraud, waste, or misuse of project resources or property?	Yes, to superior leaders
5. Internal Audit	
5.0. Is there an internal department in the organization?	Yes
5.1. What are the qualifications and experience of the internal audit department staff?	With qualified qualification certificate and experiences
5.2. To whom does the head of internal audit department report? What is this individual's position?	Leadership of the department in charge
5.3. Will the internal audit department include this project in its work program?	Yes
5.4. What actions are taken on the internal audit staff's findings?	According to the regulations
6. External Audit	
6.0. Are the organization's financial statements audited regularly by an independent auditor? Who is the auditor?	Yes, Baiyin Municipal Audit Office

6.1. When is the audit report issued?	The 2-3 months at the end of the year
6.2. Are there any delays in the audit of the entity?	Sometimes under special circumstances
6.3. Is the audit of the entity conducted according to International Standards on Auditing?	Yes
6.4. Were there any major accountability issues brought up in the audit reports in the last three years?	No
6.5. Will the independent auditor audit the project accounts or will another auditor be appointed to audit the project's financial statements?	Appointed auditor to audit
6.6. Are there any recommendations made by the independent auditors in prior audit reports or management letters that have not been implemented?	Yes
6.7. Is the project subject to an audit from an independent governmental entity in addition to the external audit?	Yes
6.8. Has the project prepared acceptable terms of reference for an annual project audit?	Yes
7. Reporting and Monitoring	
7.0. Are financial statements prepared for the organization?	Yes
7.1. What accounting standards are used to prepare the organization's financial statements?	Administrative institutions' Accounting Standards
7.2. Are financial statements prepared for the Implementing Agency?	Yes
7.3. What is the frequency of the financial statements' presentation?	Gregorian calendar year
7.4. Are the financial statements prepared in a timely fashion so as to be useful to management for decision making?	Yes
7.5. Does the reporting system need to be adapted to report on the project components?	Yes
7.6. Does the reporting system have the ability to link the financial information with the project's physical progress? If a separate system is used to gather and compile physical data, what controls are in place to reduce the risk that the physical data may not synchronize with the financial data?	Yes
7.7. Does the project have established financial management reporting responsibilities that specify which reports are to be prepared, what the reports contain, and how they are to be used?	Yes, usually prepared by the project management office
7.8. Are financial management reports used by management?	Yes
7.9. Do the financial reports compare actual expenditures with budgeted allocations?	Yes
7.10. Are financial reports prepared directly by the automated accounting system or are they prepared by spreadsheets or some other means?	Manually prepared
8. Information Systems	
8.0. Is the financial management system computerized?	Yes
8.1. Can the system produce the necessary project financial reports?	Yes
8.2. Is the staff adequately trained to maintain the system?	Yes
8.3. Does the management organization and processing system safeguard the confidentially, integrity, and availability of the data?	Stand-alone operation

Table 3: Financial management assessment questionnaire of Liuchuan Industrial Park Management Committee

Background Information	
Name of Organization	Liuchuan Industrial Park Management Committee
Component for which the organization is responsible	Liuchuan Industrial Park infrastructure
Name of individual completing this questionnaire	15009430090 ZHANG Aiyang, Accountant

Topic	**Response**

1. Implementing Agency / Executing Agency	
1.1. What is your organization's legal status / registration?	162042100404
1.2. Has your organization implemented a foreign-financed project in the past? (If yes, provide detailed project name)	No
1.3. What is your organization's governing body?	Jingyuan County Government
1.4. What is the governing body's relationship to the Government?	Superior-subordinate relationship
1.5. What are the legal financial reporting requirements for your organization?	Prepare financial reports in accordance with the requirements for administrative institutions of the PRC's financial system
1.6. Is the organizational structure appropriate for the needs of the project?	Yes
2. Funds Flow Arrangement	
2.1. Describe project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government, and other financing sources.	ADB - Gansu Finance department – Baiyin Municipal Finance Bureau – PMO - Jingyuan County Finance Bureau – Liuchuan Industrial Park
2.2. Are arrangements to transfer the proceeds of the ADB loan from the Finance Bureau to your organization satisfactory?	Yes
2.3. In the past, what have been the major problems in the receipt of ADB funds?	No ADB funds before
2.4. In which bank will the Imprest Account be opened?	Determined by the provincial financial department
2.5. Do the project Implementing Agencies have experience in the management of disbursements from ADB?	No
2.6. Does your organization have experience managing foreign exchange risks?	No
2.7. Is your organization responsible for providing counterpart funds?	Yes
2.8. What will be the counterpart sources of funds for your subcomponent construction?	Fiscal funding and self-raised
2.9. How are counterpart funds accessed?	Payment after collection by the government
2.10. How will tariffs be used to help fund the project?	Yes
2.11. Are beneficiaries required to contribute to project costs?	Not necessarily
2.12. If the beneficiaries have an option to contribute in kind are proper guidelines formulated to record and value the contribution?	Yes
2.13. How are payments made from counterpart funds?	Direct payment
3. Staffing	
3.1. What is your organization's structure for accounting or finance department? (Attach an organization chart.)	Legal person – Finance section – finance section chief – Accountant -- Cashier
3.2. Identify accounting staff. (Include name, position title, responsibilities, educational background, and professional certification)	JIA Wanqiang, the officer in charge of finance ZHANG Aiyang, Accountant
3.3. If the ADB loan is approved, what staffing changes will you make to assist with project finance and accounting?	Relevant personnel of the department in charge receive pre-service training before taking responsibility of the work; when necessary, recruit new staff with knowledge of the work
3.4. Is the accounting function adequately staffed?	Yes
3.5. Is the accounting staff adequately qualified and experienced?	Yes
3.6. Are finance and accounting staffs trained in ADB procedures?	No
3.7. Does the organization have written position descriptions, which clearly define duties, responsibilities, lines of supervision, and limits of authority for all officers, managers, and staff?	It is preparing this.
3.8. What is the existing training policy for the accounting staff?	Continuing education and pre-service training
4. Accounting Policies and Procedures	

General	
4.1. Does the organization have an accounting system, which allows for proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective subcomponents, disbursement categories, and source of funds?	Yes
4.2. What organization's accounting system will the Implementing Agency and Executing Agency use?	International financial organizations' loan management documents and information compiled (Baiyin Municipal Finance Bureau)
4.3. Are controls in place concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained?	Yes
4.4. Is the chart of accounts adequate to properly account for and report on project activities and disbursements categories?	Yes
4.5. Are cost allocations to the various funding sources made accurately and in accordance with established agreements?	Yes
4.6. Are the general ledger and subsidiary ledgers reconciled and in balance?	Balance and consistent
4.7. Are all accounting and supporting documents retained on a permanent basis in a defined system which allows authorized users easy access?	Can keep for a long time
Segregation of Duties	
4.8. Are the following functional responsibilities performed by different units or persons:	
4.8.1. Authorize transactions	Yes
4.8.2. Record transactions	Yes
4.8.3. Maintain custody of assets involved in transaction	Yes
4.9. Are the functions for ordering, receiving, accounting for goods and services segregated?	Yes
4.10. Are bank reconciliations prepared by someone other than those who make or approve payments?	Yes
Budgeting System	
4.11. Do budgets include physical and financial targets?	Yes
4.12. Are budgets prepared for all significant activities in sufficient detail to provide a meaningful tool with which to monitor subsequent performance?	Yes
4.13. Are actual expenditures compared with the budget with reasonable frequency, and explanations required for significant variations from the budget?	Yes
4.14. Are approvals for variations from budget required in advance?	Yes
4.15. Who is responsible for preparation and approval of budgets?	The budget department
4.16. How are budgets prepared and approved?	According to the "budget law"
4.17. Are procedures in place to plan project activities, collect information from the units in charge of different projects, and prepare budgets?	Yes
4.18. Are the project plans and budgets of project activities realistic, based on valid assumptions, and developed by knowledgeable individuals?	Yes
Payments	
4.19. Do invoicing processing procedures provide for:	
4.19.1. Copies of purchase orders and receiving reports be obtained directly from issuing departments?	Yes
4.19.2. Comparison of invoice quantities, prices, and terms with those indicated on the purchase order and with records of goods actually received?	Yes
4.19.3. Comparison of invoice quantities with those indicated on the receiving report?	Yes
4.19.4. Checking accuracy of calculations?	Yes
4.20. Are all invoices:	Yes

4.20.1. Stamped PAID?	Yes
4.20.2. Dated?	Yes
4.20.3. Reviewed and approved?	Yes
4.20.4. Marked for account code assignment?	Yes
4.21. What controls exist for the preparation of payroll?	Prepare according to the approved manpower in the institutional setup and personal qualifications
4.22. How are changes to the payroll authorized?	To the personnel department for examination and approval
Policies and Procedures	
4.23. What is the basis of accounting (e.g. cash or accrual)?	Accrual accounting
4.24. What accounting standards are followed?	Administrative institution accounting system
4.25. Does the organization have adequate policies and procedures manual to guide activities and ensure staff accountability?	Yes
4.26. Is the accounting policy and procedure manual updated for project activities?	Yes
4.27. Do procedures exist to ensure that only authorized persons can alter or establish a new accounting principle, policy, or procedure to be used by the organization?	Yes
4.28. Are written policies and procedures covering all routine financial management and related administrative activities?	Yes
4.29. Do policies and procedures clearly define conflict of interest and related party transactions (real and apparent) and provide safeguards to protect the organization?	Accounting law
4.30. Are manuals distributed to appropriate personnel?	Yes
Cash and banking	
4.31. Indicate names and positions of authorized signatories of the bank accounts.	Zhang Aiyang, accountant
4.32. Does the organization maintain an adequate up-to-date cashbook, recording receipts and payments?	Yes
4.33. What controls exist for the following activities:	
4.33.1. Collection of revenues?	Handled by a specially-assigned person
4.33.2. Timely deposit of receipts?	Yes
4.33.3. Recording of receipts at each collection location?	Yes
4.34. Are bank statements and cashbook reconciled on a monthly basis?	Yes
4.35. Are unusual items on the bank reconciliation reviewed and approved by a responsible officer?	Yes
4.36. How quickly are receipts deposited?	On the same day
Safeguarding Assets	
4.37. Describe the system to record assets and protect them from fraud, waste, and abuse?	The state-owned assets management system
4.38. Are subsidiary records of fixed assets and stocks kept up to date?	Yes
4.39. Are subsidiary records of assets and stocks reconciled to control accounts?	Yes
4.40. How frequent are physical inventories of fixed assets and stocks?	Once a year (if necessary, at any time)
4.41. Are assets covered by insurance policies?	No
Other Offices and Implementing Agencies	
4.42. Are there other implementing agencies participating in implementation?	Yes
4.43. Has the Project Management Office (PMO) established controls and procedures for flow of funds, financial information, accountability, and audits in relation to other offices or implementing agencies?	Yes
4.44. Does information among different implementing agencies flow	Yes

in an accurate and timely fashion?	
4.45. Are periodic reconciliations of financial information performed among the different implementing agencies?	Yes
Other	
4.46. Has the PMO advised employees to whom to report if they suspect fraud, waste, or misuse of project resources or property?	Yes, to superior leaders
5. Internal Audit	
5.1. Is there an internal department in the organization?	No
5.2. What are the qualifications and experience of the internal audit department staff?	
5.3. To whom does the head of internal audit department report? What is this individual's position?	
5.4. Will the internal audit department include this project in its work program?	
5.5. What actions are taken on the internal audit staff's findings?	
6. External Audit	
6.1. Are the organization's financial statements audited regularly by an independent auditor? Who is the auditor?	Yes, Jingyuan County Audit office
6.2. When is the audit report issued?	The 2-3 months at the end of the year
6.3. Are there any delays in the audit of the entity?	Sometimes under special circumstances
6.4. Is the audit of the entity conducted according to International Standards on Auditing?	No
6.5. Were there any major accountability issues brought up in the audit reports in the last three years?	No
6.6. Will the independent auditor audit the project accounts or will another auditor be appointed to audit the project's financial statements?	Appoint another auditor to audit
6.7. Are there any recommendations made by the independent auditors in prior audit reports or management letters that have not been implemented?	Yes
6.8. Is the project subject to an audit from an independent governmental entity in addition to the external audit?	Yes
6.9. Has the project prepared acceptable terms of reference for an annual project audit?	Yes
7. Reporting and Monitoring	
7.1. Are financial statements prepared for the organization?	Yes
7.2. What accounting standards are used to prepare the organization's financial statements?	Administrative institution's accounting standards
7.3. Are financial statements prepared for the Implementing Agency?	Yes
7.4. What is the frequency of the financial statements' presentation?	The Gregorian calendar year
7.5. Are the financial statements prepared in a timely fashion so as to be useful to management for decision making?	Yes
7.6. Does the reporting system need to be adapted to report on the project components?	Yes
7.7. Does the reporting system have the ability to link the financial information with the project's physical progress? If a separate system is used to gather and compile physical data, what controls are in place to reduce the risk that the physical data may not synchronize with the financial data?	Yes
7.8. Does the project have established financial management reporting responsibilities that specify which reports are to be prepared, what the reports contain, and how they are to be used?	Yes
7.9. Are financial management reports used by management?	Yes
7.10. Do the financial reports compare actual expenditures with budgeted allocations?	Yes
7.11. Are financial reports prepared directly by the automated accounting system or are they prepared by spreadsheets or some other means?	Manually prepared

8. Information Systems	
8.1. Is the financial management system computerized?	Yes
8.2. Can the system produce the necessary project financial reports?	Yes
8.3. Is the staff adequately trained to maintain the system?	No
8.4. Does the management organization and processing system safeguard the confidentially, integrity, and availability of the data?	

Table 4: Financial management assessment questionnaire of Baiyin Municipal Public Security Bureau Traffic Police Detachment

Background Information	
Name of Organization	Baiyin Municipal Public Security Bureau Traffic Police Detachment
Component for which the organization is responsible	Intelligent transport system
Name of individual completing this questionnaire	YAN Xiong, Deputy section chief of finance section, Traffic police detachment

Topic	Response
1. Implementing Agency / Executing Agency	
1.1. What is your organization's legal status / registration?	State organ
1.2. Has your organization implemented a foreign-financed project in the past? (If yes, provide detailed project name)	No
1.3. What is your organization's governing body?	Baiyin Municipal Public Security Bureau
1.4. What is the governing body's relationship to the Government?	Subordinate
1.5. What are the legal financial reporting requirements for your organization?	Unable to set requirements
1.6. Is the organizational structure appropriate for the needs of the project?	Yes
2. Funds Flow Arrangement	
2.1. Describe project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government, and other financing sources.	The detachment reports the plan to the superior, for the financial department of the municipal government's examination and approval, and assigning quota for payment
2.2. Are arrangements to transfer the proceeds of the ADB loan from the Finance Bureau to your organization satisfactory?	Satisfactory
2.3. In the past, what have been the major problems in the receipt of ADB funds?	No
2.4. In which bank will the Imprest Account be opened?	ICBC
2.5. Do the project Implementing Agencies have experience in the management of disbursements from ADB?	No
2.6. Does your organization have experience managing foreign exchange risks?	No
2.7. Is your organization responsible for providing counterpart funds?	No
2.8. What will be the counterpart sources of funds for your subcomponent construction?	No
2.9. How are counterpart funds accessed?	Payment after collection by the government
2.10. How will tariffs be used to help fund the project?	Yes
2.11. Are beneficiaries required to contribute to project costs?	Yes
2.12. If the beneficiaries have an option to contribute in kind are proper guidelines formulated to record and value the contribution?	Have related information
2.13. How are payments made from counterpart funds?	Transfer payment
3. Staffing	
3.1. What is your organization's structure for accounting or finance department? (Attach an organization chart.)	The detachment consists of a finance department, with a section chief, deputy section chief, accountant, cashier and bill

	administrator.
3.2. Identify accounting staff. (Include name, position title, responsibilities, educational background, and professional certification)	Shi Chunyan, the chief of finance department, university graduate, without professional qualifications Yan Xiong, deputy chief of finance department, university graduate, without professional qualifications
3.3. If the ADB loan is approved, what staffing changes will you make to assist with project finance and accounting?	There is no need to change
3.4. Is the accounting function adequately staffed?	Not adequate
3.5. Is the accounting staff adequately qualified and experienced?	Have qualifications, with no experience in this project
3.6. Are finance and accounting staffs trained in ADB procedures?	No
3.7. Does the organization have written position descriptions, which clearly define duties, responsibilities, lines of supervision, and limits of authority for all officers, managers, and staff?	No
3.8. What is the existing training policy for the accounting staff?	Focus on combining training and self-study by internet
4. Accounting Policies and Procedures	
General	
4.1. Does the organization have an accounting system, which allows for proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective subcomponents, disbursement categories, and source of funds?	Yes
4.2. What organization's accounting system will the Implementing Agency and Executing Agency use?	International financial organizations' loan management documents and information compiled (Baiyin Municipal Finance Bureau)
4.3. Are controls in place concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained?	There are controls in place.
4.4. Is the chart of accounts adequate to properly account for and report on project activities and disbursements categories?	Yes
4.5. Are cost allocations to the various funding sources made accurately and in accordance with established agreements?	Yes
4.6. Are the general ledger and subsidiary ledgers reconciled and in balance?	Balance and consistent
4.7. Are all accounting and supporting documents retained on a permanent basis in a defined system which allows authorized users easy access?	Can keep for a long time
Segregation of Duties	
4.8. Are the following functional responsibilities performed by different units or persons:	
4.8.1. Authorize transactions	The leader in charge will authorize these.
4.8.2. Record transactions	The financial department will record these.
4.8.3. Maintain custody of assets involved in transaction	The police security department maintains custody.
4.9. Are the functions for ordering, receiving, accounting for goods and services segregated?	Yes
4.10. Are bank reconciliations prepared by someone other than those who make or approve payments?	Yes
Budgeting System	
4.11. Do budgets include physical and financial targets?	Yes
4.12. Are budgets prepared for all significant activities in sufficient detail to provide a meaningful tool with which to monitor subsequent performance?	Yes
4.13. Are actual expenditures compared with the budget with	Yes

reasonable frequency, and explanations required for significant variations from the budget?	
4.14. Are approvals for variations from budget required in advance?	Yes
4.15. Who is responsible for preparation and approval of budgets?	The financial department
4.16. How are budgets prepared and approved?	Relevant departments put forward a plan with justification and data; the approval will be by a whole group.
4.17. Are procedures in place to plan project activities, collect information from the units in charge of different projects, and prepare budgets?	Yes
4.18. Are the project plans and budgets of project activities realistic, based on valid assumptions, and developed by knowledgeable individuals?	Yes
Payments	
4.19. Do invoicing processing procedures provide for:	
4.19.1. Copies of purchase orders and receiving reports be obtained directly from issuing departments?	Yes
4.19.2. Comparison of invoice quantities, prices, and terms with those indicated on the purchase order and with records of goods actually received?	Yes
4.19.3. Comparison of invoice quantities with those indicated on the receiving report?	Yes
4.19.4. Checking accuracy of calculations?	Yes
4.20. Are all invoices:	Yes
4.20.1. Stamped PAID?	Yes
4.20.2. Dated?	Yes
4.20.3. Reviewed and approved?	Yes
4.20.4. Marked for account code assignment?	Yes
4.21. What controls exist for the preparation of payroll?	The financial department prepares it according to a notice of the administrative department.
4.22. How are changes to the payroll authorized?	The municipal government's personnel department will authorize them.
Policies and Procedures	
4.23. What is the basis of accounting (e.g. cash or accrual)?	Accrual accounting
4.24. What accounting standards are followed?	Administrative units accounting system
4.25. Does the organization have adequate policies and procedures manual to guide activities and ensure staff accountability?	Yes
4.26. Is the accounting policy and procedure manual updated for project activities?	No
4.27. Do procedures exist to ensure that only authorized persons can alter or establish a new accounting principle, policy, or procedure to be used by the organization?	Yes
4.28. Are written policies and procedures covering all routine financial management and related administrative activities?	Yes
4.29. Do policies and procedures clearly define conflict of interest and related party transactions (real and apparent) and provide safeguards to protect the organization?	Financial management system
4.30. Are manuals distributed to appropriate personnel?	Yes
Cash and banking	
4.31. Indicate names and positions of authorized signatories of the bank accounts.	SHI Chunyan, the finance director QIANG Kezhi, accountant of the finance department ZHANG Huili, cashier of the finance department

4.32. Does the organization maintain an adequate up-to-date cashbook, recording receipts and payments?	Yes
4.33. What controls exist for the following activities:	
4.33.1. Collection of revenues?	Yes
4.33.2. Timely deposit of receipts?	Yes
4.33.3. Recording of receipts at each collection location?	Yes
4.34. Are bank statements and cashbook reconciled on a monthly basis?	Yes
4.35. Are unusual items on the bank reconciliation reviewed and approved by a responsible officer?	Yes
4.36. How quickly are receipts deposited?	On the same day
Safeguarding Assets	
4.37. Describe the system to record assets and protect them from fraud, waste, and abuse?	Financial management system Fixed assets management system
4.38. Are subsidiary records of fixed assets and stocks kept up to date?	Yes
4.39. Are subsidiary records of assets and stocks reconciled to control accounts?	Yes
4.40. How frequent are physical inventories of fixed assets and stocks?	Every year
4.41. Are assets covered by insurance policies?	Vehicles are insured.
Other Offices and Implementing Agencies	
4.42. Are there other implementing agencies participating in implementation?	Yes
4.43. Has the Project Management Office (PMO) established controls and procedures for flow of funds, financial information, accountability, and audits in relation to other offices or implementing agencies?	No
4.44. Does information among different implementing agencies flow in an accurate and timely fashion?	Yes
4.45. Are periodic reconciliations of financial information performed among the different implementing agencies?	Yes
Other	
4.46. Has the PMO advised employees to whom to report if they suspect fraud, waste, or misuse of project resources or property?	Yes, to report to the superior department
5. Internal Audit	
5.1. Is there an internal department in the organization?	Yes
5.2. What are the qualifications and experience of the internal audit department staff?	Have accounting qualifications with abundant experience
5.3. To whom does the head of internal audit department report? What is this individual's position?	Report to the principal responsible person, DI Shengyu, whose post is Baiyin Municipal Public Security Bureau deputy director, Traffic Police Detachment Division Marshal
5.4. Will the internal audit department include this project in its work program?	Yes
5.5. What actions are taken on the internal audit staff's findings?	Report to this unit the major audit results and put forward corresponding suggestions
6. External Audit	
6.1. Are the organization's financial statements audited regularly by an independent auditor? Who is the auditor?	Yes, audited by Baiyin Municipal Audit Bureau on a regular basis
6.2. When is the audit report issued?	After the audit
6.3. Are there any delays in the audit of the entity?	No
6.4. Is the audit of the entity conducted according to International Standards on Auditing?	No; according to the national standard
6.5. Were there any major accountability issues brought up in the audit reports in the last three years?	No
6.6. Will the independent auditor audit the project accounts or will another auditor be appointed to audit the project's financial	Independent auditors to audit

statements?	
6.7. Are there any recommendations made by the independent auditors in prior audit reports or management letters that have not been implemented?	Yes
6.8. Is the project subject to an audit from an independent governmental entity in addition to the external audit?	Yes
6.9. Has the project prepared acceptable terms of reference for an annual project audit?	Yes
7. Reporting and Monitoring	
7.1. Are financial statements prepared for the organization?	Yes
7.2. What accounting standards are used to prepare the organization's financial statements?	Administrative units accounting system
7.3. Are financial statements prepared for the Implementing Agency?	Yes
7.4. What is the frequency of the financial statements' presentation?	On a monthly basis
7.5. Are the financial statements prepared in a timely fashion so as to be useful to management for decision making?	Yes
7.6. Does the reporting system need to be adapted to report on the project components?	No
7.7. Does the reporting system have the ability to link the financial information with the project's physical progress? If a separate system is used to gather and compile physical data, what controls are in place to reduce the risk that the physical data may not synchronize with the financial data?	The existing financial reporting system can associate the financial information with information on the progress of the project.
7.8. Does the project have established financial management reporting responsibilities that specify which reports are to be prepared, what the reports contain, and how they are to be used?	Yes
7.9. Are financial management reports used by management?	Yes
7.10. Do the financial reports compare actual expenditures with budgeted allocations?	Yes
7.11. Are financial reports prepared directly by the automated accounting system or are they prepared by spreadsheets or some other means?	Generated by financial software
8. Information Systems	
8.1. Is the financial management system computerized?	No
8.2. Can the system produce the necessary project financial reports?	No
8.3. Is the staff adequately trained to maintain the system?	No
8.4. Does the management organization and processing system safeguard the confidentially, integrity, and availability of the data?	No

Table 5: Financial management assessment questionnaire of Baiyin Mining and Metallurgy Professional Technology School

Background Information	
Name of Organization	Baiyin Mining and Metallurgy Professional Technology School
Component for which the organization is responsible	Technical and Vocational Education and Training
Name of individual completing this questionnaire	FENG Yuan, The treasurer

Topic	**Response**
1. Implementing Agency / Executing Agency	
1.1. What is your organization's legal status / registration?	162040000111
1.2. Has your organization implemented a foreign-financed project in the past? (If yes, provide detailed project name)	No
1.3. What is your organization's governing body?	Baiyin Municipal Government
1.4. What is the governing body's relationship to the Government?	Superior-subordinate relationship

Topic	Response
1.5. What are the legal financial reporting requirements for your organization?	
1.6. Is the organizational structure appropriate for the needs of the project?	Can satisfy
2. Funds Flow Arrangement	
2.1. Describe project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government, and other financing sources.	
2.2. Are arrangements to transfer the proceeds of the ADB loan from the Finance Bureau to your organization satisfactory?	Satisfactory
2.3. In the past, what have been the major problems in the receipt of ADB funds?	No
2.4. In which bank will the Imprest Account be opened?	Bank of China
2.5. Do the project Implementing Agencies have experience in the management of disbursements from ADB?	No
2.6. Does your organization have experience managing foreign exchange risks?	No
2.7. Is your organization responsible for providing counterpart funds?	Responsible
2.8. What will be the counterpart sources of funds for your subcomponent construction?	Municipal financial funding and business income
2.9. How are counterpart funds accessed?	Payment after collection by the government
2.10. How will tariffs be used to help fund the project?	Yes
2.11. Are beneficiaries required to contribute to project costs?	
2.12. If the beneficiaries have an option to contribute in kind are proper guidelines formulated to record and value the contribution?	
2.13. How are payments made from counterpart funds?	
3. Staffing	
3.1. What is your organization's structure for accounting or finance department? (Attach an organization chart.)	
3.2. Identify accounting staff. (Include name, position title, responsibilities, educational background, and professional certification)	
3.3. If the ADB loan is approved, what staffing changes will you make to assist with project finance and accounting?	Set up special financial institution and financial personnel, in order to strengthen the financial and accounting management of the project
3.4. Is the accounting function adequately staffed?	Yes
3.5. Is the accounting staff adequately qualified and experienced?	Yes
3.6. Are finance and accounting staffs trained in ADB procedures?	No
3.7. Does the organization have written position descriptions, which clearly define duties, responsibilities, lines of supervision, and limits of authority for all officers, managers, and staff?	Clear
3.8. What is the existing training policy for the accounting staff?	A professional financial personnel training every year
4. Accounting Policies and Procedures	
General	
4.1. Does the organization have an accounting system, which allows for proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective subcomponents, disbursement categories, and source of funds?	Yes
4.2. What organization's accounting system will the Implementing Agency and Executing Agency use?	Institutions and enterprises' accounting system
4.3. Are controls in place concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained?	Yes
4.4. Is the chart of accounts adequate to properly account for and report on project activities and disbursements categories?	Yes

Topic	Response
4.5. Are cost allocations to the various funding sources made accurately and in accordance with established agreements?	Yes
4.6. Are the general ledger and subsidiary ledgers reconciled and in balance?	Balance and consistent
4.7. Are all accounting and supporting documents retained on a permanent basis in a defined system which allows authorized users easy access?	Yes
Segregation of Duties	
4.8. Are the following functional responsibilities performed by different units or persons:	By different departments and persons
4.8.1. Authorize transactions	
4.8.2. Record transactions	
4.8.3. Maintain custody of assets involved in transaction	
4.9. Are the functions for ordering, receiving, accounting for goods and services segregated?	Yes
4.10. Are bank reconciliations prepared by someone other than those who make or approve payments?	Yes
Budgeting System	
4.11. Do budgets include physical and financial targets?	Yes
4.12. Are budgets prepared for all significant activities in sufficient detail to provide a meaningful tool with which to monitor subsequent performance?	Yes
4.13. Are actual expenditures compared with the budget with reasonable frequency, and explanations required for significant variations from the budget?	Yes
4.14. Are approvals for variations from budget required in advance?	Yes
4.15. Who is responsible for preparation and approval of budgets?	
4.16. How are budgets prepared and approved?	Prepare budgets appropriately according to the contents and details of the project; examination and approval according to the project schedule
4.17. Are procedures in place to plan project activities, collect information from the units in charge of different projects, and prepare budgets?	Yes
4.18. Are the project plans and budgets of project activities realistic, based on valid assumptions, and developed by knowledgeable individuals?	Yes
Payments	
4.19. Do invoicing processing procedures provide for:	Yes
4.19.1. Copies of purchase orders and receiving reports be obtained directly from issuing departments?	
4.19.2. Comparison of invoice quantities, prices, and terms with those indicated on the purchase order and with records of goods actually received?	
4.19.3. Comparison of invoice quantities with those indicated on the receiving report?	
4.19.4. Checking accuracy of calculations?	
4.20. Are all invoices:	Yes
4.20.1. Stamped PAID?	
4.20.2. Dated?	
4.20.3. Reviewed and approved?	
4.20.4. Marked for account code assignment?	
4.21. What controls exist for the preparation of payroll?	
4.22. How are changes to the payroll authorized?	
Policies and Procedures	
4.23. What is the basis of accounting (e.g. cash or accrual)?	Cash basis
4.24. What accounting standards are followed?	Institution accounting standards
4.25. Does the organization have adequate policies and procedures manual to guide activities and ensure staff accountability?	Yes

Topic	Response
4.26. Is the accounting policy and procedure manual updated for project activities?	Yes
4.27. Do procedures exist to ensure that only authorized persons can alter or establish a new accounting principle, policy, or procedure to be used by the organization?	Yes
4.28. Are written policies and procedures covering all routine financial management and related administrative activities?	Yes
4.29. Do policies and procedures clearly define conflict of interest and related party transactions (real and apparent) and provide safeguards to protect the organization?	
4.30. Are manuals distributed to appropriate personnel?	Yes
Cash and banking	
4.31. Indicate names and positions of authorized signatories of the bank accounts.	FENG Yuan, Financial director
4.32. Does the organization maintain an adequate up-to-date cashbook, recording receipts and payments?	Yes
4.33. What controls exist for the following activities:	
4.33.1. Collection of revenues?	Issue receipts for business transactions and record every one
4.33.2. Timely deposit of receipts?	Deposit in time
4.33.3. Recording of receipts at each collection location?	Record in time
4.34. Are bank statements and cashbook reconciled on a monthly basis?	Monthly check
4.35. Are unusual items on the bank reconciliation reviewed and approved by a responsible officer?	Yes
4.36. How quickly are receipts deposited?	On the same day
Safeguarding Assets	
4.37. Describe the system to record assets and protect them from fraud, waste, and abuse?	
4.38. Are subsidiary records of fixed assets and stocks kept up to date?	Up to date
4.39. Are subsidiary records of assets and stocks reconciled to control accounts?	Consistent
4.40. How frequent are physical inventories of fixed assets and stocks?	One year
4.41. Are assets covered by insurance policies?	
Other Offices and Implementing Agencies	
4.42. Are there other implementing agencies participating in implementation?	
4.43. Has the Project Management Office (PMO) established controls and procedures for flow of funds, financial information, accountability, and audits in relation to other offices or implementing agencies?	
4.44. Does information among different implementing agencies flow in an accurate and timely fashion?	
4.45. Are periodic reconciliations of financial information performed among the different implementing agencies?	
Other	
4.46. Has the PMO advised employees to whom to report if they suspect fraud, waste, or misuse of project resources or property?	Yes, Commission for Disciplinary Inspection
5. Internal Audit	
5.1. Is there an internal department in the organization?	Yes
5.2. What are the qualifications and experience of the internal audit department staff?	Qualified, experience in place
5.3. To whom does the head of internal audit department report? What is this individual's position?	LIANG Huiming, the dean
5.4. Will the internal audit department include this project in its work program?	Include
5.5. What actions are taken on the internal audit staff's findings?	
6. External Audit	
6.1. Are the organization's financial statements audited regularly by an independent auditor? Who is the auditor?	Yes, Baiyin Municipal Audit Office

Topic	Response
6.2. When is the audit report issued?	The end of each year
6.3. Are there any delays in the audit of the entity?	No
6.4. Is the audit of the entity conducted according to International Standards on Auditing?	Yes
6.5. Were there any major accountability issues brought up in the audit reports in the last three years?	No
6.6. Will the independent auditor audit the project accounts or will another auditor be appointed to audit the project's financial statements?	Baiyin Municipal Audit Office
6.7. Are there any recommendations made by the independent auditors in prior audit reports or management letters that have not been implemented?	Yes
6.8. Is the project subject to an audit from an independent governmental entity in addition to the external audit?	Baiyin Municipal Audit Office
6.9. Has the project prepared acceptable terms of reference for an annual project audit?	Yes
7. Reporting and Monitoring	
7.1. Are financial statements prepared for the organization?	Yes
7.2. What accounting standards are used to prepare the organization's financial statements?	Institution accounting standards
7.3. Are financial statements prepared for the Implementing Agency?	Yes
7.4. What is the frequency of the financial statements' presentation?	One year
7.5. Are the financial statements prepared in a timely fashion so as to be useful to management for decision making?	Prepare timely
7.6. Does the reporting system need to be adapted to report on the project components?	Yes
7.7. Does the reporting system have the ability to link the financial information with the project's physical progress? If a separate system is used to gather and compile physical data, what controls are in place to reduce the risk that the physical data may not synchronize with the financial data?	The existing financial reporting system can associate the financial information with information on the progress of the project.
7.8. Does the project have established financial management reporting responsibilities that specify which reports are to be prepared, what the reports contain, and how they are to be used?	Yes
7.9. Are financial management reports used by management?	Yes
7.10. Do the financial reports compare actual expenditures with budgeted allocations?	Yes
7.11. Are financial reports prepared directly by the automated accounting system or are they prepared by spreadsheets or some other means?	Automatically generated by the accounting system
8. Information Systems	
8.1. Is the financial management system computerized?	Computerized
8.2. Can the system produce the necessary project financial reports?	Yes
8.3. Is the staff adequately trained to maintain the system?	Received enough training
8.4. Does the management organization and processing system safeguard the confidentially, integrity, and availability of the data?	Authorization and encryption

Table 6: Financial management assessment questionnaire of Jingyuan Bureau of Human Resources and Social Security

Background Information	
Name of Organization	Jingyuan Bureau of Human Resources and Social Security
Component for which the organization is responsible	Technical and Vocational Education and Training
Name of individual completing this questionnaire	CHEN Shengzhi, accountant

Topic	Response
1. Implementing Agency / Executing Agency	
1.1. What is your organization's legal status / registration?	0139135-03
1.2. Has your organization implemented a foreign-financed project in the past? (If yes, provide detailed project name)	No
1.3. What is your organization's governing body?	Jingyuan Municipal Government

Topic	Response
1.4. What is the governing body's relationship to the Government?	Superior-subordinate relationship
1.5. What are the legal financial reporting requirements for your organization?	In accordance with the requirements for administrative institutions of the PRC's financial system and disclose their financial reports
1.6. Is the organizational structure appropriate for the needs of the project?	Yes
2. Funds Flow Arrangement	
2.1. Describe project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government, and other financing sources.	ADB – Gansu Provincial Finance Department – Baiyin Municipal Finance Bureau – PMO – Jingyuan County Finance Bureau – Jingyuan County Bureau of Human Resources and Social Security
2.2. Are arrangements to transfer the proceeds of the ADB loan from the Finance Bureau to your organization satisfactory?	Yes
2.3. In the past, what have been the major problems in the receipt of ADB funds?	No ADB loan before
2.4. In which bank will the Imprest Account be opened?	Determined by the financial department
2.5. Do the project Implementing Agencies have experience in the management of disbursements from ADB?	No
2.6. Does your organization have experience managing foreign exchange risks?	No
2.7. Is your organization responsible for providing counterpart funds?	Yes
2.8. What will be the counterpart sources of funds for your subcomponent construction?	Fiscal funding and self-raised
2.9. How are counterpart funds accessed?	Payment after collection by the government
2.10. How will tariffs be used to help fund the project?	No
2.11. Are beneficiaries required to contribute to project costs?	Not necessarily
2.12. If the beneficiaries have an option to contribute in kind are proper guidelines formulated to record and value the contribution?	No
2.13. How are payments made from counterpart funds?	Direct payment
3. Staffing	
3.1. What is your organization's structure for accounting or finance department? (Attach an organization chart.)	Legal person – finance unit – financial section chief – accountant – cashier
3.2. Identify accounting staff. (Include name, position title, responsibilities, educational background, and professional certification)	CHEN Shengzhi, financial section chief CHEN Shengzhi, accountant
3.3. If the ADB loan is approved, what staffing changes will you make to assist with project finance and accounting?	Relevant personnel of the department in charge receive pre-service training before taking responsibility of the work; when necessary, recruit new staff with knowledge of the work
3.4. Is the accounting function adequately staffed?	Yes
3.5. Is the accounting staff adequately qualified and experienced?	Yes
3.6. Are finance and accounting staffs trained in ADB procedures?	No
3.7. Does the organization have written position descriptions, which clearly define duties, responsibilities, lines of supervision, and limits of authority for all officers, managers, and staff?	Are preparing them
3.8. What is the existing training policy for the accounting staff?	Continuing education and pre-service training

Topic	Response
4. Accounting Policies and Procedures	
General	
4.1. Does the organization have an accounting system, which allows for proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective subcomponents, disbursement categories, and source of funds?	Yes
4.2. What organization's accounting system will the Implementing Agency and Executing Agency use?	International financial organizations' loan management documents and information compiled (Baiyin Municipal Finance Bureau)
4.3. Are controls in place concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained?	Yes
4.4. Is the chart of accounts adequate to properly account for and report on project activities and disbursements categories?	Yes
4.5. Are cost allocations to the various funding sources made accurately and in accordance with established agreements?	Yes
4.6. Are the general ledger and subsidiary ledgers reconciled and in balance?	Balance and consistent
4.7. Are all accounting and supporting documents retained on a permanent basis in a defined system which allows authorized users easy access?	Can keep for a long time
Segregation of Duties	
4.8. Are the following functional responsibilities performed by different units or persons:	
4.8.1. Authorize transactions	Yes
4.8.2. Record transactions	Yes
4.8.3. Maintain custody of assets involved in transaction	Yes
4.9. Are the functions for ordering, receiving, accounting for goods and services segregated?	Yes
4.10. Are bank reconciliations prepared by someone other than those who make or approve payments?	Yes
Budgeting System	
4.11. Do budgets include physical and financial targets?	Yes
4.12. Are budgets prepared for all significant activities in sufficient detail to provide a meaningful tool with which to monitor subsequent performance?	Yes
4.13. Are actual expenditures compared with the budget with reasonable frequency, and explanations required for significant variations from the budget?	Yes
4.14. Are approvals for variations from budget required in advance?	Yes
4.15. Who is responsible for preparation and approval of budgets?	The budget department
4.16. How are budgets prepared and approved?	According to the Budget Law
4.17. Are procedures in place to plan project activities, collect information from the units in charge of different projects, and prepare budgets?	Yes
4.18. Are the project plans and budgets of project activities realistic, based on valid assumptions, and developed by knowledgeable individuals?	Yes
Payments	
4.19. Do invoicing processing procedures provide for:	
4.19.1. Copies of purchase orders and receiving reports be obtained directly from issuing departments?	Yes
4.19.2. Comparison of invoice quantities, prices, and terms with those indicated on the purchase order and with records of goods actually received?	Yes

Topic	Response
4.19.3. Comparison of invoice quantities with those indicated on the receiving report?	Yes
4.19.4. Checking accuracy of calculations?	Yes
4.20. Are all invoices:	
4.20.1. Stamped PAID?	Yes
4.20.2. Dated?	Yes
4.20.3. Reviewed and approved?	Yes
4.20.4. Marked for account code assignment?	Yes
4.21. What controls exist for the preparation of payroll?	Prepare according to the approved manpower in the institutional setup and personal qualifications
4.22. How are changes to the payroll authorized?	To the personnel department for examination and approval
Policies and Procedures	
4.23. What is the basis of accounting (e.g. cash or accrual)?	Accrual accounting
4.24. What accounting standards are followed?	Administrative units accounting system
4.25. Does the organization have adequate policies and procedures manual to guide activities and ensure staff accountability?	Yes
4.26. Is the accounting policy and procedure manual updated for project activities?	Yes
4.27. Do procedures exist to ensure that only authorized persons can alter or establish a new accounting principle, policy, or procedure to be used by the organization?	Yes
4.28. Are written policies and procedures covering all routine financial management and related administrative activities?	Yes
4.29. Do policies and procedures clearly define conflict of interest and related party transactions (real and apparent) and provide safeguards to protect the organization?	Strictly implement the accounting law
4.30. Are manuals distributed to appropriate personnel?	Yes
Cash and banking	
4.31. Indicate names and positions of authorized signatories of the bank accounts.	CHEN Shengzhi, accountant
4.32. Does the organization maintain an adequate up-to-date cashbook, recording receipts and payments?	Yes
4.33. What controls exist for the following activities:	
4.33.1. Collection of revenues?	Handled by a specially-assigned person
4.33.2. Timely deposit of receipts?	Yes
4.33.3. Recording of receipts at each collection location?	Yes
4.34. Are bank statements and cashbook reconciled on a monthly basis?	Yes
4.35. Are unusual items on the bank reconciliation reviewed and approved by a responsible officer?	Yes
4.36. How quickly are receipts deposited?	On the same day
Safeguarding Assets	
4.37. Describe the system to record assets and protect them from fraud, waste, and abuse?	The state-owned assets management system
4.38. Are subsidiary records of fixed assets and stocks kept up to date?	Yes
4.39. Are subsidiary records of assets and stocks reconciled to control accounts?	Yes
4.40. How frequent are physical inventories of fixed assets and stocks?	Once a year (if necessary, at any time)
4.41. Are assets covered by insurance policies?	No
Other Offices and Implementing Agencies	
4.42. Are there other implementing agencies participating in implementation?	Yes
4.43. Has the Project Management Office (PMO) established controls and procedures for flow of funds, financial	Yes

Topic	Response
information, accountability, and audits in relation to other offices or implementing agencies?	
4.44. Does information among different implementing agencies flow in an accurate and timely fashion?	Yes
4.45. Are periodic reconciliations of financial information performed among the different implementing agencies?	Yes
Other	
4.46. Has the PMO advised employees to whom to report if they suspect fraud, waste, or misuse of project resources or property?	Yes, to superior leaders
5. Internal Audit	
5.1. Is there an internal department in the organization?	Yes
5.2. What are the qualifications and experience of the internal audit department staff?	Assistant accountant
5.3. To whom does the head of internal audit department report? What is this individual's position?	Director
5.4. Will the internal audit department include this project in its work program?	Include
5.5. What actions are taken on the internal audit staff's findings?	Circulate a notice, rectify etc.
6. External Audit	
6.1. Are the organization's financial statements audited regularly by an independent auditor? Who is the auditor?	Yes, Jingyuan County Audit Office
6.2. When is the audit report issued?	The 2-3 months at the end of the year
6.3. Are there any delays in the audit of the entity?	Sometimes under special circumstances
6.4. Is the audit of the entity conducted according to International Standards on Auditing?	No
6.5. Were there any major accountability issues brought up in the audit reports in the last three years?	No
6.6. Will the independent auditor audit the project accounts or will another auditor be appointed to audit the project's financial statements?	Appoint another auditor to audit
6.7. Are there any recommendations made by the independent auditors in prior audit reports or management letters that have not been implemented?	Yes
6.8. Is the project subject to an audit from an independent governmental entity in addition to the external audit?	Yes
6.9. Has the project prepared acceptable terms of reference for an annual project audit?	Yes
7. Reporting and Monitoring	
7.1. Are financial statements prepared for the organization?	Yes
7.2. What accounting standards are used to prepare the organization's financial statements?	Administrative institution accounting standards
7.3. Are financial statements prepared for the Implementing Agency?	Yes
7.4. What is the frequency of the financial statements' presentation?	The Gregorian calendar year
7.5. Are the financial statements prepared in a timely fashion so as to be useful to management for decision making?	Ye
7.6. Does the reporting system need to be adapted to report on the project components?	Yes
7.7. Does the reporting system have the ability to link the financial information with the project's physical progress? If a separate system is used to gather and compile physical data, what controls are in place to reduce the risk that the physical data may not synchronize with the financial data?	Yes
7.8. Does the project have established financial management reporting responsibilities that specify which reports are to be prepared, what the reports contain, and how they are to be	Yes

Topic	Response
used?	
7.9. Are financial management reports used by management?	Yes
7.10. Do the financial reports compare actual expenditures with budgeted allocations?	Yes
7.11. Are financial reports prepared directly by the automated accounting system or are they prepared by spreadsheets or some other means?	Manually prepared
8. Information Systems	
8.1. Is the financial management system computerized?	Yes
8.2. Can the system produce the necessary project financial reports?	Yes
8.3. Is the staff adequately trained to maintain the system?	No
8.4. Does the management organization and processing system safeguard the confidentially, integrity, and availability of the data?	

Table 7: Financial management assessment questionnaire of Baiyin Municipal Bus Company

Background Information	
Name of Organization	Baiyin Municipal Bus Company
Component for which the organization is responsible	Intelligent transport system
Name of individual completing this questionnaire	OU Guoping, chief of the finance section

Topic	Response
1. Implementing Agency / Executing Agency	
1.1. What is your organization's legal status / registration?	State-owned enterprise code number 43829006-5 Registration no. 620400100002480 (1, 1)
1.2. Has your organization implemented a foreign-financed project in the past? (If yes, provide detailed project name)	No
1.3. What is your organization's governing body?	Baiyin Municipal Transport Bureau
1.4. What is the governing body's relationship to the Government?	Subordinate
1.5. What are the legal financial reporting requirements for your organization?	No legal requirements
1.6. Is the organizational structure appropriate for the needs of the project?	Yes
2. Funds Flow Arrangement	
2.1. Describe project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government, and other financing sources.	The company reports its plan for the municipal government's financial department's examination and approval, and assigning quota for payment
2.2. Are arrangements to transfer the proceeds of the ADB loan from the Finance Bureau to your organization satisfactory?	Yes
2.3. In the past, what have been the major problems in the receipt of ADB funds?	No
2.4. In which bank will the Imprest Account be opened?	Agricultural Bank of China
2.5. Do the project Implementing Agencies have experience in the management of disbursements from ADB?	No
2.6. Does your organization have experience managing foreign exchange risks?	No
2.7. Is your organization responsible for providing counterpart funds?	No
2.8. What will be the counterpart sources of funds for your subcomponent construction?	No
2.9. How are counterpart funds accessed?	Payment after collection by the government
2.10. How will tariffs be used to help fund the project?	Yes

Topic	Response
2.11. Are beneficiaries required to contribute to project costs?	Yes
2.12. If the beneficiaries have an option to contribute in kind are proper guidelines formulated to record and value the contribution?	Have related information
2.13. How are payments made from counterpart funds?	Transfer payment
3. Staffing	
3.1. What is your organization's structure for accounting or finance department? (Attach an organization chart.)	The company sets consists of a finance department, with a section chief, accountant, cashier and bill administrator
3.2. Identify accounting staff. (Include name, position title, responsibilities, educational background, and professional certification)	OU Guoping, the finance director, university graduate, accounting professional qualifications MA Yunxia, accountant, technical secondary school, assistant accountant
3.3. If the ADB loan is approved, what staffing changes will you make to assist with project finance and accounting?	There is no need to change.
3.4. Is the accounting function adequately staffed?	Enough
3.5. Is the accounting staff adequately qualified and experienced?	Have qualifications, with no experience in this project
3.6. Are finance and accounting staffs trained in ADB procedures?	No
3.7. Does the organization have written position descriptions, which clearly define duties, responsibilities, lines of supervision, and limits of authority for all officers, managers, and staff?	No
3.8. What is the existing training policy for the accounting staff?	Focus on training and self-study combining network
4. Accounting Policies and Procedures	
General	
4.1. Does the organization have an accounting system, which allows for proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective subcomponents, disbursement categories, and source of funds?	Yes
4.2. What organization's accounting system will the Implementing Agency and Executing Agency use?	International financial organizations' loan management documents and information compiled (Baiyin Municipal Finance Bureau)
4.3. Are controls in place concerning the preparation and approval of transactions, ensuring that all transactions are correctly made and adequately explained?	There are control measures
4.4. Is the chart of accounts adequate to properly account for and report on project activities and disbursements categories?	Yes
4.5. Are cost allocations to the various funding sources made accurately and in accordance with established agreements?	Yes
4.6. Are the general ledger and subsidiary ledgers reconciled and in balance?	Balance and consistent
4.7. Are all accounting and supporting documents retained on a permanent basis in a defined system which allows authorized users easy access?	Can keep for a long time
Segregation of Duties	
4.8. Are the following functional responsibilities performed by different units or persons:	
4.8.1. Authorize transactions	The leader in charge examines and approves them.
4.8.2. Record transactions	The financial department records them.
4.8.3. Maintain custody of assets involved in transaction	The financial and user departments maintain custody.

Topic	Response
4.9. Are the functions for ordering, receiving, accounting for goods and services segregated?	Yes
4.10. Are bank reconciliations prepared by someone other than those who make or approve payments?	Yes
Budgeting System	
4.11. Do budgets include physical and financial targets?	Yes
4.12. Are budgets prepared for all significant activities in sufficient detail to provide a meaningful tool with which to monitor subsequent performance?	Yes
4.13. Are actual expenditures compared with the budget with reasonable frequency, and explanations required for significant variations from the budget?	Yes
4.14. Are approvals for variations from budget required in advance?	Yes
4.15. Who is responsible for preparation and approval of budgets?	The financial department
4.16. How are budgets prepared and approved?	Relevant departments put forward a plan with justification and data; the approval will be by a whole group.
4.17. Are procedures in place to plan project activities, collect information from the units in charge of different projects, and prepare budgets?	Yes
4.18. Are the project plans and budgets of project activities realistic, based on valid assumptions, and developed by knowledgeable individuals?	Yes
Payments	
4.19. Do invoicing processing procedures provide for:	
4.19.1. Copies of purchase orders and receiving reports be obtained directly from issuing departments?	Yes
4.19.2. Comparison of invoice quantities, prices, and terms with those indicated on the purchase order and with records of goods actually received?	Yes
4.19.3. Comparison of invoice quantities with those indicated on the receiving report?	Yes
4.19.4. Checking accuracy of calculations?	Yes
4.20. Are all invoices:	
4.20.1. Stamped PAID?	Yes
4.20.2. Dated?	Yes
4.20.3. Reviewed and approved?	Yes
4.20.4. Marked for account code assignment?	Yes
4.21. What controls exist for the preparation of payroll?	The financial department prepares it according to a notice of the labor department.
4.22. How are changes to the payroll authorized?	Authorized by the municipal transport bureau and the company's personnel department
Policies and Procedures	
4.23. What is the basis of accounting (e.g. cash or accrual)?	Accrual accounting
4.24. What accounting standards are followed?	Enterprise accounting system
4.25. Does the organization have adequate policies and procedures manual to guide activities and ensure staff accountability?	Yes
4.26. Is the accounting policy and procedure manual updated for project activities?	No
4.27. Do procedures exist to ensure that only authorized persons can alter or establish a new accounting principle, policy, or procedure to be used by the organization?	Yes
4.28. Are written policies and procedures covering all routine financial management and related administrative activities?	Yes

Topic	Response
4.29. Do policies and procedures clearly define conflict of interest and related party transactions (real and apparent) and provide safeguards to protect the organization?	Financial management system
4.30. Are manuals distributed to appropriate personnel?	Yes
Cash and banking	
4.31. Indicate names and positions of authorized signatories of the bank accounts.	WAN Yong, Company's legal person, manager OU Guoping, the finance director ZHANG Yanli, the finance department's cashier
4.32. Does the organization maintain an adequate up-to-date cashbook, recording receipts and payments?	Yes
4.33. What controls exist for the following activities:	
4.33.1. Collection of revenues?	Yes
4.33.2. Timely deposit of receipts?	Yes
4.33.3. Recording of receipts at each collection location?	Yes
4.34. Are bank statements and cashbook reconciled on a monthly basis?	Ye
4.35. Are unusual items on the bank reconciliation reviewed and approved by a responsible officer?	Yes
4.36. How quickly are receipts deposited?	In the same day
Safeguarding Assets	
4.37. Describe the system to record assets and protect them from fraud, waste, and abuse?	Financial management system Fixed assets management system
4.38. Are subsidiary records of fixed assets and stocks kept up to date?	Yes
4.39. Are subsidiary records of assets and stocks reconciled to control accounts?	Yes
4.40. How frequent are physical inventories of fixed assets and stocks?	Every year
4.41. Are assets covered by insurance policies?	Vehicles are insured.
Other Offices and Implementing Agencies	
4.42. Are there other implementing agencies participating in implementation?	Yes
4.43. Has the Project Management Office (PMO) established controls and procedures for flow of funds, financial information, accountability, and audits in relation to other offices or implementing agencies?	No
4.44. Does information among different implementing agencies flow in an accurate and timely fashion?	Yes
4.45. Are periodic reconciliations of financial information performed among the different implementing agencies?	Yes
Other	
4.46. Has the PMO advised employees to whom to report if they suspect fraud, waste, or misuse of project resources or property?	Yes, Report to the superior departments
5. Internal Audit	
5.1. Is there an internal department in the organization?	Yes
5.2. What are the qualifications and experience of the internal audit department staff?	Have accounting qualifications, with abundant experience
5.3. To whom does the head of internal audit department report? What is this individual's position?	Report to the principal of this unit, WAN Yong, whose position is Baiyin Municipal Transport Bureau's deputy director, Municipal Public Transport Company's general manager
5.4. Will the internal audit department include this project in its work program?	Include
5.5. What actions are taken on the internal audit staff's findings?	Report to this unit the major audit results and put forward corresponding suggestions

Topic	Response
6. External Audit	
6.1. Are the organization's financial statements audited regularly by an independent auditor? Who is the auditor?	Yes, By Baiyin Municipal Audit Bureau audit on a regular basis
6.2. When is the audit report issued?	After the audit
6.3. Are there any delays in the audit of the entity?	No
6.4. Is the audit of the entity conducted according to International Standards on Auditing?	No; According to the national standard
6.5. Were there any major accountability issues brought up in the audit reports in the last three years?	No
6.6. Will the independent auditor audit the project accounts or will another auditor be appointed to audit the project's financial statements?	Independent auditors to audit
6.7. Are there any recommendations made by the independent auditors in prior audit reports or management letters that have not been implemented?	Implement
6.8. Is the project subject to an audit from an independent governmental entity in addition to the external audit?	Yes
6.9. Has the project prepared acceptable terms of reference for an annual project audit?	Yes
7. Reporting and Monitoring	
7.1. Are financial statements prepared for the organization?	Yes
7.2. What accounting standards are used to prepare the organization's financial statements?	Enterprise accounting system
7.3. Are financial statements prepared for the Implementing Agency?	Yes
7.4. What is the frequency of the financial statements' presentation?	On a monthly basis
7.5. Are the financial statements prepared in a timely fashion so as to be useful to management for decision making?	Yes
7.6. Does the reporting system need to be adapted to report on the project components?	No
7.7. Does the reporting system have the ability to link the financial information with the project's physical progress? If a separate system is used to gather and compile physical data, what controls are in place to reduce the risk that the physical data may not synchronize with the financial data?	The existing financial reporting system can make the financial information and progress of the projects information associated with it
7.8. Does the project have established financial management reporting responsibilities that specify which reports are to be prepared, what the reports contain, and how they are to be used?	Yes
7.9. Are financial management reports used by management?	Yes
7.10. Do the financial reports compare actual expenditures with budgeted allocations?	Yes
7.11. Are financial reports prepared directly by the automated accounting system or are they prepared by spreadsheets or some other means?	Generated by financial software
8. Information Systems	
8.1. Is the financial management system computerized?	No
8.2. Can the system produce the necessary project financial reports?	No
8.3. Is the staff adequately trained to maintain the system?	No
8.4. Does the management organization and processing system safeguard the confidentially, integrity, and availability of the data?	No

Supplementary Document 3 A
Technical Analysis of the Water Supply Component

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ABBREVIATIONS

ADB	Asian Development Bank		lpcd	liter per capita per day
CNY	China Yuan		MEP	Ministry of Environmental Protection
DI	Ductile Iron		NCB	National Competitive Bidding
EA	Executing Agency		O&M	Operation and Maintenance
EPB	Environmental Protection Bureau		PACl	Poly-aluminum chloride
FRP	Fiberglass Reinforced Plastics		PCCP	Pre-stressed Concrete Cylinder Pipe
FSR	Feasibility Study Report		PE	Polyethylene
FYP	Five-Year Plan		PPTA	Project Preparatory Technical Assistance
GRP	Glass-reinforced Plastic		PRC	People's Republic of China
HDPE	High Density Polyethylene		PS	Pumping Station
IA	Implementation Agency		PSP	Private Sector Participation
ICB	International Competitive Bidding		RCP	Reinforced Concrete Pipe
IDC	Interest during construction		RoW	Right-of-way
LA	Land Acquisition		uPVC	Un-plasticized Polyvinyl Chloride
LCA	Least Cost Analysis		WS	Water Supply
LDI	Local design institute		WTP	Water Treatment Plant
LIP	Liuchuan Industrial Park		WWTP	Wastewater Treatment Plant

Measures and Units

ha	hectare, = 10,000 square meters		m^3/d	cubic meters per day
km	kilometer = 1,000 meters		m^3/s	cubic meters per second
kw, kwh	kilo-watt; kilo-watt hour		mg/L	milligrams per liter (1,000 mg = 1 kilogram)
L	Liter, 1000 L = 1 cubic meter		MPa	Mega-Pascal (1 MPa = 10 bar = 100 meters)
Lpcd	liter per capita per day		mu	Chinese unit of land measure; 15 mu = 1 ha; 1 mu = 667 m^2
m	meter; m^2 = square meter		T.ds/d	tons dry solids per day
mm	millimeter, 1,000 mm = 1 meter			

Technical Analysis of the Water Supply Component

1 Water Supply System

1.1 Current Situation and Existing Problems

1. The Liuchuan Industrial Park (LIP) in Jingyuan County is composed of large areas of wasteland, small area of arable land, villages, and several enterprises that are constructed or under construction. There is insufficient ground water to be used as a water source.

2. The current water source is surface water from the Yellow River, and the water intake is located 10 km away to the southeast of the LIP and on the southern bank of the Yellow River. The water intake currently includes (a) Mitan Town Dushi Village Water Intake which serves villages and provides water for irrigation; and (b) Santan Village. The water intake is pumped to the rare earth company as it is reserved for industrial and domestic water use.

3. The Santan Water Station includes (a) one intake pumping station with 5 pumps (3 for use and 2 reserved), (b) two concrete mechanical clarification tanks and chemical dosing system each with the capacity of 10,000 m^3/d; (c) two round concrete storage tanks (2,800 m^3 and 2,500 m^3) and (d) one 30 m × 9 m brick-concrete structure semi-underground pressure pumping station consisting of 5 pressure pumps (3 for use and 2 stand-by).

4. The water distribution system consists of DN400 (a) electrically welded pipe laid during 1969; and (b) ductile cast iron pipe laid in 1982, the length of which is 12 km.

5. The current water supply system was constructed in 1969 and has the following problems:

(a). The actual treated water supply is only 15,000 m^3/d instead of the designed 20,000 m^3/d due to the aging of the pipes which have reduced capacity and high leakage. The rare earth company consumes 9,000 – 13,000 m^3 of water per day; therefore the water available for other uses is limited and cannot fulfill the water demand of the planned area.
(b). The existing water supply system was built during 1969 and upgraded in 1982. After more than 40 years of operation, the equipment no longer performs efficiently. The raw water is only clarified and treated with aluminum chloride; there is no filtration or disinfection.
(c). The aging transmission pipeline is easily broken if the pressure is too high. The pipeline goes through arable land and was laid 5 m deep underground making it difficult to repair.
(d). The location of the current intake has inadequate flood protection making it difficult and dangerous to extract water during the flooding season.

6. For the LIP to succeed, it must have a reliable water supply for the industries within its boundaries.

1.2 Plan for Water Supply

7. Local Government contracted with the Lanzhou Urban Construction Design Institute to prepare the Feasibility Study Report (FSR).

8. Take water directly from the Yellow River; provide preliminary treatment to reduce suspended solids; pump to a water treatment plant (WTP) located within the LIP, treat and distribute to industries and dormitory buildings within the IP.

9. The water distribution system within the LIP will be a looped pipe network alongside main and secondary roads with minimum service pressure of 0.28 Mega-Pascals (MPa) and below-ground fire hydrants, spaced not more than 120 meters apart.

10. Wastewater will be reclaimed and made available to industries for their use and for irrigation of landscape within the IP.

11. The Rare Earth Company owns the existing intake, treatment plant, and distribution pipelines. It is their decision about what to do with this system when the new infrastructure goes into service. However as explained in section 1.6.1 their allocation for water will be reassigned to the LIP.

1.3 Service Area

12. The service area is 23-km^2 planned area of LIP in Jingyuan County by year 2020. Ultimately the LIP will be 100 km^2 of which detailed planning for 50 km^2 is completed. See Figure 1.

Figure 1: Project Location Map

13. Previously it was planned to provide water supply to two villages inside the Industrial Park (Nanshanwei and Nanchuan Villages) and to the new Resettlement Village located to the south of LIP. However Gansu Province is providing funds for village water supply improvements through the “1236 policy” and Jingyuan County Government has provided assurance the two villages are included in the “Jingyuan County Drinking Water Safety Project” that will be completed in year 2014, so there is no need to serve them from the LIP water supply.

Table 1: Summary of the 12th Five-Year Plan for Village Drinking Water Safety Project in Liuchuan County (part of the "1236" policy)

Project: Mitan Liuchuan County pipeline expansion			Investment (units of CNY10,000)		
Beneficiary Villages	Beneficiary population by 2010	Designed water supply (m^3/d)	Central Government	Local Government	Total
Total	15,130	832	777.68	194.42	972.1
Nanshanwei Village	1,863				
Laiyao Village	1,775				
Zhangtan Village	712				
Jinchuan Village	1,975				
Luozhuang Village	1,522				
Laobawan Village	3,014				
Zhaotang Village	2,028				
Nanchuan Village	747				
Yingzui Village	1,494				

Source: Data from "Jingyuan County Drinking Water Safety Project 12th Five-Year Plan". Parts of Nanshanwei and Nanchuan Villages are inside the Liuchuan Industrial Park.

14. The Jingyuan County Mitan WTP will initially provide water to the resettlement area. At a future date the area will be served from the LIP network via a pipeline financed by the LIP.

1.4 Water Demand

15. The FSR discusses four water consumption prediction methods.

(1) Land Area: Total Land Area x Average Consumption per Unit of Land
(2) Per Capita: Total Population x Integrated Water Consumption Index (L/person-days)
(3) Land Classification: Use different consumption rates for different types of land, e.g. urban residential, industry, and agriculture. Calculate individual consumption (land classification x unit consumption for that classification) and sum.
(4) Water by Category of Use: Different usage rates by residential, commercial, institutional, industrial, agriculture, roads and landscaping, unavoidable leakage. Sum of various [size of category X unit water use for that particular category]

1.4.1 Domestic Water Demand

16. Current (year 2013) population is reported to be 13,130 of which 11,100 are with the Rare Earth Company consisting of 2,100 staff, 2,000 retired workers, and 7,000 family members (2,100 households) in the company's living community.

17. Each industry will have residential dormitory buildings for its workers. LDI estimates the Year 2020 population to be 34,000 and year 2030 population at 68,000 (according to LIP Master Plan). The Liuchuan Industrial Park Management Committee (LMC) estimates manpower requirements for year 2030 population to be 86,000. The PPTA Industrial Sector Analysis estimated the population size for LIP at 36,000 to 39,000 in 2020 and between 73,000 and 79,000 in 2030 during the night time and daytime. The population growth is irregular because it depends on when industries start operating.

18. For this analysis use the average of the estimates. For year 2020 the average of 34,000 and 39,000, rounded up, is 37,000. For year 2030 the average of 68,000 and 86,000 and 79,000 rounded up is 78,000.

19. The LDI used 120 liters per capita per day (L/c/d) as the average daily integrated domestic urban water use and assumed 100% of the population served. This is from PRC GB50013-2006, "Outdoor Water Supply Design Specification"

Table 2: Domestic Water Demand at Liuchuan Industrial Park

No.	Parameter	Unit	2013	2020	2030
1	LIP Urban Population	capita	13,130	37,000	78,000
2	Percent of Population Served	%	40%	100%	100%
3	Water Supply Serving Population	capita	5,300	37,000	78,000
4	Per capita domestic water use	L/capita/day			120
5	Domestic Water Demand	m^3/day	600	4,400	9,400

1.4.2 Water for Landscape Irrigation

20. Volume of water needed for landscape irrigation is shown in Table 3.

Table 3: Landscape Area and Irrigation Water by Year 2020

Users	Land Area (mu)	Land Area (km^2)	Rate ($m^3/km^2/d$)	Volume (m^3/d)
Dasha River greenbelt (partial)	1,417	0.95	1,000	950
Roadside landscaping	530	0.35	2,000	700
Public green area (park, residential etc.)	1,530	1.02	1,000	1,020
Corridor of high voltage electricity	1,400	0.93	1,000	930
Public square	1,950	1.3	1,000	1,300
Highway exit	412	0.27	2,000	540
Xizheng park	57	0.04	1,000	40
Total	**7,296**	**4.86**		**5,480**

Source: LMC
mu = Chinese unit of area (15 mu = 1 hectare); 100 ha = 1 km^2
km^2 = square kilometer; m^3/d = cubic meters per day

21. The LDI assumed water for landscaping would come from wastewater effluent (i.e. reclaimed water) meeting PRC Class 1A requirements. Thus it is excluded from determining the water demand.

1.4.3 Industrial Water Demand Year 2020 and Year 2030

22. Table 4 shows the estimated industrial water demand for year 2020 and Table 5 for year 2030.

Table 4: LIP Industrial Water Demand Forecast (2020)

No.	Enterprise	Area (km^2)	(m^3/d)
1	Gansu Hongtai Aluminum Co Ltd	4	8,000
2	Gansu Kaisi Ceramics Co Ltd	1.53	1,500
3	Baiyin Jiarui Ceramics Co Ltd	0.12	1,000
4	Jingyuan Power Plant (replacing existing)	0.8	6,000
5	Gansu Lantong Power Cables Co Ltd	0.19	200
6	Gansu Rare Earth New Materials Shareholding Co Ltd	2.34	8,500
7	Baiyin Honglu Aluminum Co Ltd	3.33	6,000
8	Gansu Shengyuan Agricultural Produce Storage and Transportation Co Ltd	0.67	500
9	Shanghai Zhongjin Logistics	2	3,000
10	Solar thermal power specialist equipment manufacturing park	Note 1	Note 1
11	Gansu Hengda Ceramics Co Ltd		1,500
12	Coal chemical integration project	3.06	12,000
	Service industry		
13	Education services		No special water use; assume domestic consumption.
14	Financial services		
15	Culture, sports and entertainment		
16	Water, power, environment, public infrastructure management		
17	Modern logistics		
		18.04	**48,200**

Source: FSR, PMO, and TA Consultant Notes
Industries #1, #2, #3, and #6 are already on-site but not full capacity
Industry #10 will not be within the 23 km^2 LIP

Table 5: LIP Industrial Water Demand Forecast (2030)

Industrial land	Water indicators ($10,000\ m^3/km^2 \cdot d$)	2030 Area (km^2)	2030 Water ($10,000\ m^3/d$)
Type II Industrial Land	2	5.5	11
Type III Industrial Land	3	3.4	10.2
Warehouse space	0.2	3	0.6
Total water consumption		11.9	21.8

Source: FSR Table 5.1.2.3-3;
Estimated by Land Classification method
Type I: Industrial land has no interference and pollution to living environment and public facilities;
Type II: Industrial land has some interference and pollution to living environment and public facilities;
Type III: Industrial land has serious interference and pollution to living environment and public facilities

1.4.4 Industrial Park Water Demand Year 2020 and Year 2030

23. Table 6 summarizes the total estimated water demand for the Industrial Park. Water leakage is assumed at 10% starting year 2016 when installation of the new pipeline network begins. In year 2030 water leakage is assumed to increase to 15%. Unanticipated water demand is assumed at 8% but due to rounding shows as 7% in the table.

Table 6: LIP Water Demand Forecast

		2020		2030	
		m^3/d	% of total	m^3/d	% of total
1	Domestic water use/demand	4,400	7%	9,400	3%
2	Industrial water use/demand	48,200	77%	218,000	77%
3	Pipeline Leakage (m^3/d)	5,300	8%	34,100	12%
4	Unanticipated water	4,600	7%	20,900	7%
6	Total Water Demand	62,500	100%	282,400	100%

Source: TA Consultants
Numbers rounded to nearest 100

24. Treated wastewater will be available for reuse by industries and Table 7 lists three industries planning to use it. Applying reused water to the year 2020 industrial water use/demand enables sizing the water treatment plant at 60,000 m^3/d.

Table 7: Planned Wastewater Reuse Year 2020

Industry	Water Demand (m^3/d)	Reused Water (m^3/d)	% of Demand from Reuse
Thermal Power Plant	10,000	10,000	100%
Hongtai Aluminum Plant	8,000	4,000	50%
Coal Chemistry Plant	12,000	7,700	64%
	30,000	21,700	72%

Source: TA Consultants, LDI, and PMO
Hongtai Aluminum is building the thermal power plant for its own use. It will be about 4 * 300 MW and is not the same as the Jingyuan Power Plant (2 * 1,000 MW) serving the entire LIP.

1.5 Project Components

25. The Water Supply Components listed in Table 8 are based on the water demand, the location of the intake, and the layout of the LIP.

Table 8: Water Supply Component

Sub-Component	Year 2020	Year 2030	Location
Intake Station and Raw Water Pumping Station	60,000 m^3/d	200,000 m^3/d	On the Yellow River
Raw Water Transmission Pipeline [DN1,200]	170 m	3 x 170 m	---
Preliminary Water Treatment Plant for settling solids	60,000 m^3/d	200,000 m^3/d	Santan Village
Settled Water Transmission Pipeline [DN1,200 steel pipe]	14.3 km	3 x 14.3 km	---
Water Treatment Plant (WTP)	60,000 m^3/d	200,000 m^3/d	Inside Industrial Park
Treated Water Pump Station	60,000 m^3/d	200,000 m^3/d	Next to WTP
Water Distribution Pipeline [DN400 – DN1,000; ductile iron (K9 grade)	13.97 km	57.25 km	Inside Industrial Park

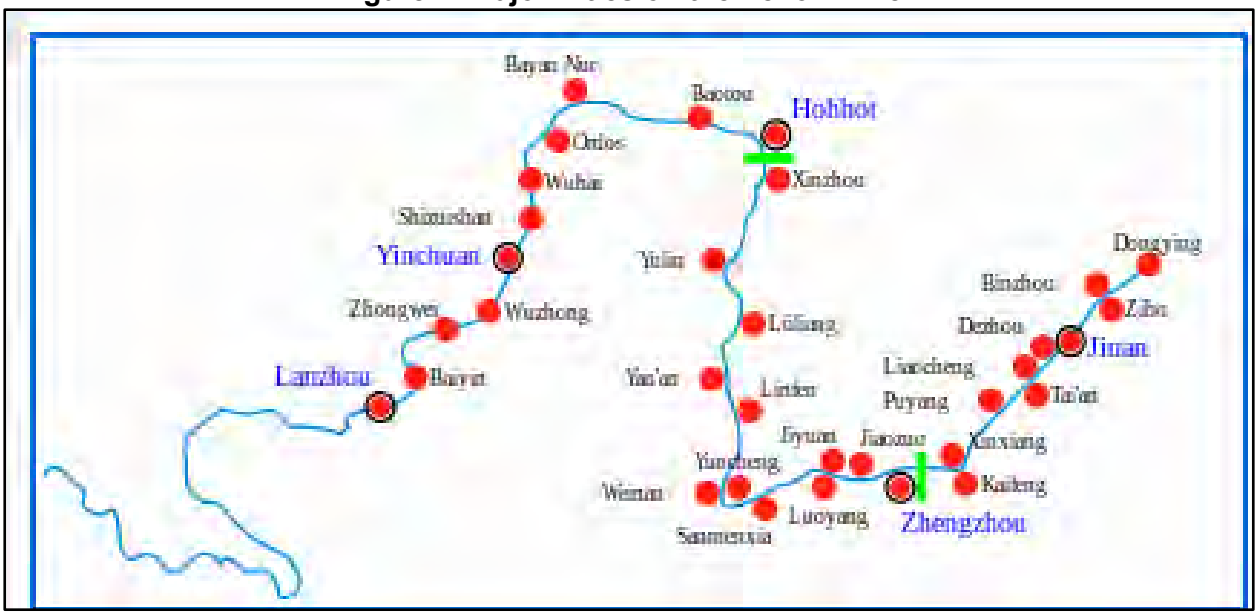
Source: FSR
DN = nominal diameter; km = kilometer; m = meter; m^3/d = cubic meters per day; MPa = Mega-Pascal (1 MPa = 10 bar); PN = Pressure Nominal

26. The total Water Distribution Pipeline is 57.25 km of which 13.97 km will be funded by the ADB Project. The LMC will do the remainder but the specific funding sources have not yet been decided.

1.6 Water Source

27. The proposed water source is the Yellow River, which is administered by the Yellow River Conservancy Commission (YRCC), a government agency of the Ministry of Water Resources (MWR). As shown in Figure 2 there are many cities that use the Yellow River as their water source.

Figure 2: Major Cities on the Yellow River



North is top. The Yellow River flows west to east.

28. YRCC is responsible for water administration of the Yellow River basin and the inland river basins in Gansu and other provinces bordering the river and it allocates the volume of water each province can withdraw.

1.6.1 Water Allocation

29. Water Allocation for Liuchuan Industrial Park[1]

[1] Mr. LI Tianping (telephone 138300065276) of the Gansu Province Water Resources Bureau (WRB)

- 258 km of the Yellow River pass through Baiyin borders and the volume is 33 billion cubic meters per year (Bm^3/y).
- Baiyin City has an allocation of 1.4 Bm^3/y (4.2% of the River flow passing through Baiyin), which is not fully used.
- Jingyuan County is allocated 0.34 Bm^3/y from Baiyin City allocation (24.3%).
- A national level plan assigned these allocations from the Yellow River in 1987.
- Allocations can be transferred.

30. The LIP WTP has a design capacity of 60,000 m^3/day equivalent to 21.9 Mm^3/y, which is 6% of Jingyuan County allocation.

31. However the planned volume of water withdrawn is calculated according to PRC "Code of Design of Outdoor Water Supply Engineering (GB50013-2006)", which specifies the volume of water required to be (a) increased by 15% for leakage, overflows, and sludge process water (i.e. sedimentation basin residuals and filter backwash) and (b) reduced by 30% because the WTP does not operate at full capacity 100% of the time for an entire year, for example reductions in output due to maintenance, due to lower water demand etc. The result of this calculation is 19.37 Mm^3/year.

$$[60{,}000\ m^3/d \times 365\ d/year] \times (1.15)/(1.3) = 19{,}370{,}000\ m^3/year$$

32. According to a Municipal document dated 25 February 2014 the approved water quota for LIP is 19.37 Mm^3/y, of which 10.23 Mm^3/y is from the Liuchuan Irrigation Improvement project, 4.3 million Mm^3/y from Rare Earth Company, and 4.84 million Mm^3/y from other irrigation districts in Jingyuan County.

33. The proposed supply amount is 60,000 m^3/d for 2020 and 200,000 m^3/d for 2030, with a design abstraction guarantee rate of 97%. The Yellow River has an average annual flow of 920 cubic meters per second (m^3/s) and a historic minimum flow of 236 m^3/s measured by the Anningdu Hydrological Station located 12.5 km from the proposed water intake and operated by the Gansu Province Bureau of Hydrological and Water Resources Survey, which is located in Lanzhou. The amount proposed to be withdrawn as a percent of Yellow River Flow is shown in Table 9.

Table 9: Proposed Flow to Be Extracted

			% of Yellow River	
Year	**m^3/day**	**m^3/s**	**Average flow**	**Low flow**
2020	60,000	0.69	0.08%	0.29%
2030	200,000	2.31	0.25%	0.98%

m^3 = cubic meter; m^3/s = cubic meters per second
Source: Yellow River flow data from Construction Project Environmental Impact Statement, July 2013

1.6.2 Water Quality

34. The Yellow River Basin Water Resources Protection Bureau of the MWR and Ministry of Environmental Protection monitor and enforce water quality. According to "2011 State of the Environment in Gansu Province" the Yellow River in Lanzhou segment is Grade II – III. This makes it suitable as a source for drinking water[2].

[2] The PRC's Environmental Quality Standards for Surface Water (GB 3838-2002) defines five water quality classes for different environmental functions: Class I for headwaters and natural reserve; Class II for 1st class of drinking water sources and habitats of rare aquatic organisms; Class III for 2nd class of drinking water sources, aquiculture and human contact; Class IV for water source of industrial use and recreation area for indirect human contact; Class V for water sources of agriculture use and landscaping requirement. There is also "worse than Class V".

35. The LDI provided water quality data from the Wujiawan water intake station located approximately 10 km upstream of the proposed water intake.

Table 10: Water Quality at Wujiawan Water Intake Station

Parameter		Class III standard	October 2012	January 2012
Water Temperature	℃	/	13	2
pH	mg/L	6-9	8.26	8.13
Dissolved Oxygen (DO)	mg/L	≥ 5	8.5	9.5
Potassium permanganate index	mg/L	≤ 6	2.4	1.9
Chemical Oxygen Demand (COD)	mg/L	≤ 20	10.1	15.6
5 Day Biochemical Oxygen Demand (BOD_5)	mg/L	≤ 4	<2.0	<2.0
Ammonia (NH_3-N)	mg/L	≤ 1.0	0.09	0.47
Total Phosphorus (TP as P)	mg/L	≤ 0.2	<0.02	0.04
TN (lakes, reservoirs, as N)	mg/L	≤ 1.0	1.78	2.54
Copper	mg/L	≤ 1.0	<0.05	<0.05
Zinc	mg/L	≤ 1.0	<0.05	<0.05
Fluoride (F-meter)	mg/L	≤ 1.0	0.21	0.21
Selenium	mg/L	≤ 0.01	<0.002	<0.002
Arsenic	mg/L	≤ 0.05	0.002	0.002
Mercury	mg/L	≤ 0.0001	<0.0001	<0.0001
Cadmium	mg/L	≤ 0.005	<0.001	<0.001
Chromium (VI)	mg/L	≤ 0.05	<0.004	<0.004
Lead	mg/L	≤ 0.05	<0.005	<0.005
Cyanide	mg/L	≤ 0.2	<0.01	<0.01
Volatile Phenols	mg/L	≤ 0.005	<0.002	<0.002
Petroleum	mg/L	≤ 0.05	<0.05	<0.05
Anionic synthetic detergents	mg/L	≤ 0.2	<0.05	<0.05
Sulfide	mg/L	≤ 0.2	<0.02	<0.02
Fecal coliforms	mg/L	≤ 10,000	88,000	30,000
Secondary Water Quality Standards (aesthetics)				
Sulfate (SO_4-meter)	mg/L	≤ 250	63	89
Chloride (Cl^-meter)	mg/L	≤ 250	28	49
Nitrate (as N)	mg/L	≤ 10	1.49	2.06
Iron	mg/L	≤ 0.3	0.12	0.06
Manganese	mg/L	≤ 0.1	<0.05	<0.05

Source: FSR Table 5.1.2.3-9

36. Data in the table show that except for total nitrogen and fecal coliform, the other indicators meet PRC class III water standards. The water treatment process should be able to deal with this, for example pre-chlorination.

37. According to the Project EIA annual average sediment concentration is 4 kilograms per cubic meter (kg/m^3), however in summer it reaches 35~35 g/m^3. Common practice for high sediment water is to provide preliminary treatment to settle out the sediment and that is the purpose of the preliminary Water Purification Plant described in section 1.8.

1.7 Intake and Raw Water Pumping Station

38. The proposed intake and raw water pumping station will be located on the left (as you face downstream) bank of the Yellow River at Santan Village. The intake will take water directly from the river through a trash rack and filter to protect the pump impellers from dirt, debris, and ice. There will be 3 inlet gates for 2020 and 4 additional for 2030. The design will retain the design of Santan intake.

39. The intake pump station is located about 20 m upstream from the previous pump station because (a) the location is close to the main water flow, the river bed is stable, the flow rate is

large, and the riverside is strong; (b) the water quality is good for the industrial and domestic use; and (c) coordination of staffing, operation, and management with the Pump Station located on the opposite side of the Yellow River that serves the WTP in Pingchuan County. Based on the water intake situation over the past 40 years, this location is reasonable and reliable.

40. Raw Water Pumping Station dimensions are: length 28 m, width 9.6 m, floor thickness 0.5 m, and sidewall thickness 0.5 m. The pump station is proposed to have three horizontal single-stage double suction centrifugal pumps with two operational and one backup. Water is pumped through pipeline length 170 m, DN1,200, steel pipe to a preliminary treatment plant. In year 2030 two additional rows of DN1,200 steel pipe are planned making a total of three.

41. For flood protection, according to "Outdoor Water Supply Design Specification" (GB50013-2006), the flood control standards for river water intake structures should not be lower than the urban flood control standard. That makes the design flood return period to be not less than 100 years.

42. The pump station floor level is 1.50 m higher than the estimated 100-year flood level, which makes it relatively safe from the flood impact.

43. Applying "Pump Station Design Specifications" (GB 50265-2010) for water pumping from rivers, the minimum operating level should be taken to ensure water will be 97% of the minimum daily average water level. For minimum daily average flow of 236 m^3/s, the water intake lowest level is set at 1,371.69 m.

Table 11: Elevations at Intake Pump Station

Location	Elevation (m)
Pump station floor level	1,380.65
100 year flood level	1,379.15
Maximum operation level	1,378.47
Design operating water level	1,372.73
Pump level	1,371.93
Minimum operation level	1,371.69
River level	1,370.14

Source: FSR
m = meter

1.8 Preliminary Water Purification Plant

44. The preliminary water purification plant will be used to remove most of the sediment from the raw water and reduce subsequent treatment load. The site is located on a land terrace above the Yellow River. Total proposed area for the plant is 198 mu.

45. According PRC CJJ40-2011 "High Turbidity Water Design Specifications", when using two-stage treatment processes the first-stage pre-sedimentation structures should have a larger volume for sediment and reliable solids processing facilities. The Design Institute evaluated (a) radial flow sedimentation tank; (b) advection sedimentation tank; and (c) inclined tube (plate) sedimentation tanks. All are suitable for gravity settling or chemical coagulation.

Table 12: Pre-Sedimentation Tank Tank-Type Comparison

Pre-Sedimentation Tank-Type	Advantages	Disadvantages	Applicable Conditions
Radial flow pre-sedimentation tank	• Easy to manage, reliable operation • Facilitates mechanical scraper • If polyacrylamide is dosed for flocculation, high purification efficiency • Large volume enabling easy adaptation to changing water quality	• Larger area • Large investment, more construction difficulties than advection	Generally applicable to large and medium-sized water pre-treatment. Widely used for treating water from the Yellow River
Advection pre-sedimentation tank	• Hydraulic conditions are good, easy management • Construction is relatively simple • Easy to connect to response equipment	• Sludge removal more difficult, more complex maintenance for mechanical sludge removal equipment • Large area	Suitable for large and medium-sized water pre-treatment
Splash plate (tube) pre-sedimentation tank	• Hydraulic conditions are good, high sedimentation efficiency • Small size, small footprint	• Sludge removal more difficult, more complex mechanical sludge removal equipment • High material consumption, higher cost	Applicable to all types of water pre-treatment

Source: FSR Table 5.1.2.8-3

46. The design consists of four circular, reinforced concrete, radial flow sedimentation tanks (diameter 60 m), pressure pump station, sludge treatment facilities, warehouse for chemical storage and dosing and other mechanical facilities. For year 2030 eight additional sedimentation tanks are planned of the same size and design.

1.8.1 Coagulant Used at the Preliminary Water Purification Plant

47. The coagulant that the LDI proposes to use is HPAM, which is more efficient in processing high sediment water with maximum sand amount of 100 kg/m³. Lanzhou City Water Company has used the HPAM to pre-treat the high turbidity water for almost 50 years, of which the result was satisfactory. Jinan City Water Company also adopted HPAM in pre-treatment for sedimentation of Yellow River water; the sediment removal performance was good. In order to further enhance the treatment effect, Jinan company uses HPAM combined with PAC dosing method, first HPAM and then PAC, which largely improved the sediment removal. This combination is referred to as composite coagulant.

48. According to the FSR, gravity settling is planned when source water sediment is less than 12 kg/m^3, and settling and addition of polyacrylamide (PAM) coagulant when it is > 12 kg/m^3. HPAM and PAC as composite coagulants are suggested for consideration if sediment content in the raw water is higher. This cut-off point for not using coagulant should be adjusted based on actual operating experience. However since the purpose of this facility is to remove as much sediment as possible in order to make subsequent treatment operations easier and less costly, it may be better to always add coagulant chemical to maximize the sedimentation

process.

1.8.2 Processing Residuals at the Preliminary Water Purification Plant

49. The sediment removed is referred to as residuals to differentiate it from “sludge” produced at wastewater treatment plants. WTP residuals have no nutrients, hence no value as a fertilizer, but in certain types of soils the residuals can improve soil porosity.

50. For the sedimentation processing: 1) If frame filter presser is applied, the size of the filter press room is 72 m × 40 m, equipment investment is CNY30,000,000, land use investment is CNY440,000, and civil construction investment is CNY1500,000. The total investment will be CNY31,940,000. 2) If the natural drying fields method is selected, the investment for drying fields is CNY3,000,000, civil construction CNY6,000,000, and mechanical equipment investment is about CNY4,800,000. The total investment is CNY13,800,000. Therefore, natural drying beds are selected due to obvious financial advantage.

51. At the preliminary water treatment plant there will be ten natural drying fields, each 20 m by 100 m, impermeable concrete floor, slope of 2% on which there are layers (from bottom to top) of gravel (0.2 m) and sand (0.9 m). Dewatering of water treatment residuals on sand drying beds produces residuals of 5% solids concentration through gravity drainage, then through further solar drying, 30% to 50% solids content. The solids will be transported to waste land near the plant for disposal to land and to fill low elevation areas as needed. According to the FSR estimation, the sludge production for preliminary WTP is 235 t/d.

1.9 Water Transmission Pipeline

1.9.1 Water Transmission Pump Station

52. The Preliminary WTP is about 130 m lower elevation than the main WTP in the LIP so the LDI evaluated two options for pumping water from the preliminary treatment plant to the main water treatment plant located in the LIP.

53. Single-stage booster pump station with design lift 146 m and equipped with three sets of horizontal, single-stage, double-suction centrifugal pumps with two operating and one standby.

54. Scheme of two booster pump stations: each with design head 63 m and each equipped with three sets of horizontal, single-stage, double-suction centrifugal pumps of 2+1 operating mode.

55. The annual power operating costs for the two options are almost the same but the capital construction is about CNY1.6 million less for one station rather than two; the decision is to have one transmission pipeline pumping station.

1.9.2 Water Transmission Pipeline Diameter Selection

56. In the short term, a single pipeline will be adopted with a design flow of 0.92 m^3/s. The distance from the pressure pump station to the secondary WTP is 14.3 km. The different diameters are compared in the FSR, as follows:

Table 13: Evaluation of Transmission Pipeline Diameters

Option	Diameter	Flow Speed (m/s)	Pump station head (m)	Cost (CNY10,000)	Yearly operation cost (CNY10,000)	25 years operation present value (CNY10,000)	Total (CNY10,000)
1	DN1,000	1.13	164	3754	2703	28855	32609
2	DN1,100	0.93	157	4722	2253	24046	28768
3	DN1,200	0.79	153	5799	2140	22843	28642

Source: FSR Table 5.1.2.8-5
CNY = Chinese Yuan; DN = nominal diameter; m = meter; m/s = meter per second

57. From the comparison, the DN1,200 option has a more reasonable pump station head and pipeline flow compared to other options, and lower construction cost and operation cost. It will be buried at depth 1.5 m ~ 3.5 m except for a tunnel section.

58. In the long-term, the water intake will be 3.07 m^3/s so two additional DN1,200 pipelines will be added in the future (after year 2020).

1.9.3 Water Transmission Pipeline Materials Selection

59. Based on the evaluation shown in Table 14, Steel Pipe is recommended as the water transmission pipeline.

Table 14: Evaluation of Transmission Pipeline Materials

Materials	Advantages	Disadvantages	Unit Cost in CNY per m of DN1,000
Steel pipe	Can withstand high internal pressure Easy to work and flexible and convenient for terrain with special requirements (such as river crossings and road crossings)	Removal of rust and corrosion protection needs to be done both inside and outside pipe. High cost	1,745
Ductile Iron Pipe (DIP)	A wide range of applications, high strength, good toughness, large elongation, and corrosion resistance Use socket joints, high adaptability to deformation, good water-sealing effect, and good hydraulic conditions	Thrust piers to be added at pipe bends No price advantage for diameters larger than 1,000 mm	1,646
Pre-stressed Concrete Cylinder Pipe (PCCP)	Strong ability to withstand external pressure Strong ability to withstand internal pressure High precision steel socket joints, good water sealing performance, low pipe leakage Good corrosion resistance, service life can be up to 50 years Easy to locate pipe	Transportation and installation is not easy due to heavy weight. Maximum PN is 2 MPa for domestic product Mortar and concrete will dry thus affecting the pipe quality as pipes are placed for a long time.	1,398
Fiberglass Reinforced Plastic Pipe (FRP)	Corrosion resistance, light weight, high strength, resistant to scaling Use socket joints, the pipe internal wall is smooth, excellent hydrological properties	The impact resistance is poor, need careful handling. Trench foundation requires sand cushion; backfill requirements are high.	1,240

Source: FSR Table 5.1.2.8-6
DN = nominal diameter; MPa = Mega-Pascal (1 MPa = 10 bar); PN = Pressure Nominal

- Due to the uneven quality on the market, FRP pipe products are not widely used in the PRC.
- The heavy weight of PCCP makes transportation and installation difficult, particularly in the route to LIP, which is undulating terrain and landscape.
- Steel pipe has good adaptability for complex terrain, handles high water pressure and has been successfully used in various high-lift pumping stations.

60. Therefore, in terms of engineering safety considerations, as well as successful experience from other projects, steel pipe is selected as the water transmission pipeline.

1.9.4 Water Transmission Pipeline Route

61. The straight distance from the preliminary WTP to the secondary WTP is about 10 km. However the route selected is not the shortest (straight-line) distance in order to avoid going through unfavorable terrain and to take full advantage of the geological conditions. The basis for selecting the pipeline route with the lowest construction cost involved consideration of these principles.

a. Select the shortest routes as much as possible;
b. The layout should be as straight as possible, minimize pipeline turns, lower the pipeline water pressure (head), and decrease the construction and operation cost;
c. Minimize the frequencies of going through river, railway, highway, and mountainous areas, and try to avoid any unfavorable geological conditions.

62. The Design Institute evaluated three options (see Annex 1 of this report) for pipeline route based on a single-stage booster pump station, single DN1,200 pipeline.

Table 15: Length Comparison for 3 Transmission Pipeline Routes

	Option 1	Option 2	Option 3
Total designed length	14.3 km	16.08 km	15.44 km
Tunnel length	0.205 km	1.85 km	3.32 km

Table 16: Economical and Technical Comparison for 3 Transmission Pipeline Routes

No.	Item	Unit	Option 1		Option 2		Option 3	
			Quantities	Cost	Quantities	Cost	Quantities	Cost
1	Earth excavation	m^3	558,695.34	746.42	650,415.71	868.95	632,998.73	845.68
2	Rock excavation	m^3	34,699.28	276.17	15,120.00	120.34	6,048.00	48.14
3	Earth backfill	m^3	545,950.93	994.18	615,216.14	1,120.31	589,520.40	1,073.52
4	Rock excavation into mountain	m^3	52,432.38	417.31	98,942.76	787.49	48,576.01	386.62
5	Sand cushion	m^3	26,095.09	268.78	30,732.03	316.54	29,508.85	303.94
6	Valve pit	set	37.00	11.10	46.00	13.80	44.00	13.20
7	Steel elbow	t	140.00	384.16	171.50	470.60	164.50	451.39
8	Steel pipe	t	7,481.82	5,312.10	8,689.17	6,169.31	8,343.33	5,923.76
9	External PE Corrosion protection	m^2	17,737.73	124.17	20,600.08	144.20	19,780.17	138.46
10	Internal Epoxy Corrosion protection	m^2	16,784.64	100.71	19,493.17	116.96	18,717.33	112.30
11	Temporary land acquisition (Arable land)	m^2	400,186.19	299.99	448,838.24	336.46	430,974.03	323.07
12	Temporary land acquisition	m^2	422,962.37	317.07	474,383.40	355.61	455,502.47	341.45
13	Permanent land acquisition	m^2	3,108.00	46.60	3,864.00	57.93	3,696.00	55.41
14	Tunnel	m	205.00	1,025.00	1,942.50	9,712.50	3,486.00	17,430.00
15	Total	CNY10,000		10323.74		20590.98		27446.95

Source: FSR Table 5.1.2.8-1: Economic and Technical Comparison of Transmission Pipeline Routes
CNY = Chinese Yuan; m = meter; t = ton

63. Evaluation of options

(a). Cost comparison. Estimated costs for tunnel construction assumed a unit rate of CNY50,000/meter. From Table 16, it can be seen that the option 1 has the lowest cost.
(b). For option 1, the pipeline length is relatively short, and follows the original pipeline layout, which can be used as reference giving strong controllability; the tunnel length is short and easy to construct, and has a shorter construction period; pipeline sections that need to go through the mountain are short; excavation work is less; however, since the surrounding landscape is featured with bottomland and precipice back and forth, inter-cross construction is inevitable, which makes maintenance somewhat more difficult.
(c). For option 2, the advantage is that the pipeline inter-cross construction is less, and operation and maintenance is relatively easier; the disadvantages are that the pipeline length and tunnel length are longer, construction is difficult, and the construction period is long; moreover, the section that goes through the mountain is long, excavation work is heavy, and construction cost is high.
(d). Option 3 route is close to Road No. 109, operation and maintenance is easy, and construction road cost less; but the disadvantage is that the pipeline length and tunnel is long, construction is complex and the construction period is long.

64. In summary, Transmission Pipeline Route option 1 is recommended for this project.

1.9.5 Water Transmission Pipeline Construction

65. For Year 2020 a single pipeline will be installed and in year 2030 another two pipelines will be laid alongside the first. So the local government needs to secure the right-of-way for the year 2030 pipes, which is estimated at 30 m width along the pipeline route. The tunnel is being designed and constructed to accommodate the year 2030 piping.

66. Along the transmission pipeline there are planned 3 regulator towers, 18 exhaust wells, 14 vent wells, and 6 manholes. These are needed to release air, drain water, and do inspections.

1.10 Secondary Water Purification Plant

67. The secondary water purification plant is located inside the LIP (see Figure 1) with total area of 10 hectares (150 mu). The location is selected for the following reasons: (a) close to the water distribution network inside the LIP; (b) good geological foundation and bearing capacity; (c) convenient location for construction and operation management; and (d) convenient discharge conditions.

68. The water treatment process is as follows: pre-chlorination, coagulation with poly-aluminum chloride, sedimentation, filtration by V-filter, and clean water tank with disinfection. This is standard process for Yellow River, water which typically has high turbidity.

69. According to the LDI the treated water quality will meet the national "Drinking Water Health Standards" GB5749-2006.

70. There will be a takeoff interface before secondary WTP for industries needing water with lower quality and also takeoff interfaces from the sedimentation tank in the secondary WTP. There will have to be a separate pipeline conveying the lower quality water directly to the user and the LIP and the User will construct that.

1.10.1 Sedimentation Process

71. The key point in the design is that the Yellow River often has high levels of sediment. So the methods and equipment selected need to have high efficiency. The Local Design Institute evaluated different coagulants (Aluminum Sulfate versus Poly-Aluminum Chloride); different

chemical mixing methods (rapid mixer versus orifice plate); different reaction tanks (reaction cell separator; folding reaction cell; mechanical reactor unit; and eyelet mesh reaction cell); and different tank configurations (circular-vertical versus rectangular-horizontal). Table 19 summarizes the results of their selection.

1.10.2 Filtration Process

72. V-shaped filter divided into 8 separate cells operated at a rate of 7.6 m/hour. The filter duty cycle is 24 hours. There will be air-water backwash with air at 15 L/s•m^2 and water backwashing intensity at 3 L/s•m^2.

1.10.3 Disinfection Process

73. Disinfection is by liquid chlorine due to wide application, mature technology, and low cost. Ultra-Violet (UV) was considered but rejected due to high investment, short operating life, and high maintenance cost during operations.

Table 17: Comparisons of Potable Water Disinfection Methods

	Chlorine	Chlorine Dioxide	Ozone	UV irradiation
Applications	Water and wastewater	Water and wastewater	Drinking water and swimming pool water	Water and wastewater
Advantages	Mature technology, readily available equipment, low investment, and low operating costs	Less investment in equipment and smaller impact on the environment than chlorine	Small, efficient sterilization	Small footprint, sterilization, high efficiency, small risk, no secondary pollution
Disadvantages	Hazard if released to the atmosphere	Small footprint; more operator effort	No residual disinfection; requires equipment to capture and convert excess ozone	No residual disinfection; reports of short lamp life; used lamps must be disposed of as hazardous waste
Infrastructure Investment	Low	Low	High	Higher
Operating Costs	Low	Low	High	Higher

Source: FSR and TA Consultants

74. The maximum chlorine dosage is planned to be 1.5 mg/L. For a volume of 60,000 m^3/d that makes the total daily amount of chlorine to be 90 kg/day.

1.10.4 Water Treatment Plant Clear Well

75. The clean water tank (clear well) has total volume of 20,000 m^3 and is sub-divided into two cells, each 10,000 m^3. The size provides 20% of the design capacity. It will be a reinforced concrete structure. The clean water tank overflow pipe connects to the storm sewer plant.

1.10.5 Water Treatment Plant Solids Processing

76. Due to space limitations around the WTP the residuals (solids) from sedimentation tanks and filter backwash will go to a conditioning tank for gravity settling and concentration. Then the solids go through one of two sets of horizontal spiral centrifuge and ancillary screw conveyor for dewatering processes, i.e. one operating and one stand-by. The equipment costs of this option will be CNY1.5 million.

Table 18: Comparison of WTP Solids Dewatering Processes

Method	Advantages	Disadvantages
Drying beds	Simple equipment Low costs Needs minimal operation attention 20% to 60% water content	Affected by weather, air temperature; and relative humidity The dry upper crust can affect the dewatering of bottom layers. Need large land area Impact surrounding environment due to odor issues
Vacuum filter	Domestic equipment and technology are mature. Inorganic flocculants can be used; lower cost for agents	The sludge water content is higher than 80%. Filter cloth washing must be done regularly with high requirements.
Belt filter press	The water content of the treated sludge is lower. Simple equipment, low cost	Fluctuations in sludge quality (e.g. % solids) impact operations. Dosing control is difficult. Only polymer flocculent can be used. Requires large volume of wash-water Poor adaptability when sludge properties changes High requirements for operators
Filter Press	The water content of the treated WTP sludge is 50% to 70%. High recovery for dewatered residual Inorganic coagulant can be used.	The structure is complex. Intermittent operation Needs more land area and staffing High requirements for operators
Centrifuge	Wide range of applications can be adapted to sludge with various properties. Good separation performance; solid content is 25% to 30% Suspended Solids in centrate smaller than 1 g/L; high recovery of solid Large treatment amount, small land area Minimal impact on the surrounding environment due to closed system The installation is simple. Less chemical flocculants are used. Less staff is needed; less operation fees	Domestic equipment needs to be improved. More expensive if imported equipment is used Large power consumption

Source: FSR Table 5.1.2.8-4
Centrate is the liquid separated from the solids by the centrifuge. Centrate has high solids concentration so at a WTP it is disposed of into a sewer or into a lagoon while at a WWTP it is sent back to the headworks.

77. After the centrifuge dewatering process, the sludge with water content is about 80% it will be used for to fill land depressions, form berms, or used in a mix for building materials[3]. The sludge production for the secondary WTP is estimated to be 80 t/d.

1.11 Infrastructure Selection for the Secondary Water Purification Plant

78. After reviewing the FSR and discussion with the Project PMO and LDI, the following infrastructure will be selected for the secondary water purification plant:

[3] PRC Standard GB16889-2008 specifies 60% water content of sludge disposed in landfills. So at 80% water content the WTP residuals are not suitable for soil cover at the landfill.

Table 19: Selected Infrastructure for Secondary Water Purification Plant

Treatment structure		Type	Reason
Dosing room	Coagulant	Poly aluminum chloride (PAC)	High efficiency, lower dose, low outflow turbidity, small floc, good filter quality, high thermal adaptability, large pH adaptability, simple equipment, convenient operation, small corrosiveness and good power
	Dosing system	Wet metering pump	Dosing with fixed quantity and convenient to use
	Mixing method	Orifice plate mixing device	Good mixing quality, shorter mixing time, convenient installation, less land occupation, saving water treatment cost
Reaction tank		Small eyelet grid reaction tank	Shorten flocculation time and enhance flocculation effect. High density of aluminum floc, easy for sedimentation
Sedimentation tank		Horizontal sedimentation tank	High adaptability to raw water, stable treatment effect, rich operation experiences, convenient management
Filter		V-shape filter	Long filtering cycle, high utilization rate of the filter material layer, high filtering speed, good filtering quality. Aerated water backwash because it uses less water
Supply pumping station		Start with semi self-fill; semi-underground pumping room	The pumping room lays shallow to the underground and is convenient for construction. Small civil work investment. Convenient ventilation within the room
Disinfection method		Liquid chlorine disinfection	Widely adopted. It will also perform oxidation besides its primary function of disinfection. Adding Chlorine is easy; dosing amount is accurate; price is low; and will provide residual disinfection in the pipeline
Clean water tank		Underground and rectangular tank	Convenient for construction. But the land occupation area is large; therefore underground type is more appropriate.
Solids treatment		Horizontal spiral centrifugal machine	Widely adopted. Applicable for sludge of diverse quality. Less land occupation. Small environmental impact

Source: Design Institute and FSR 5.1.2.10-3

1.12 Treated Water Pump Station

79. A water booster pump station will be located next to the WTP and equipped with six single-stage horizontal centrifugal pumps, four in use and two stand-by.

1.13 Summary of Pump Stations in the LIP Water Supply System

80. Table 20 summarizes the number and specification of the pumps at the three pump stations. Each pump station will be equipped with a level transmitter and pressure display controller.

Table 20: Summary of Pumps at Pump Stations

Pump Station	Purpose	Pump Specification	Number of Pumps
Raw Water Intake	Extract Yellow River water	Single-stage double suction pump H = 32 m , Q = 1, 885 m³/h, N = 220 kW	2+1
Settled Water	Pump water through the Transmission Pipeline	Single-stage double suction pump H = 142 m, Q = 1,700 m³/h, N = 1,000 kW	2+1
Treated Water Pump Station	Pump water through the LIP Distribution System	Single-stage double suction pump H = 94 m, Q = 1,260 m³/h, N = 500 kW	4+2

H = head; h = hour; kW = kilowatt; m = meter; m^3 = cubic meter; N = electricity required; Q = flow rate
Number of Pumps = in use + stand-by
Source: extracted from FSR Table 5.1.2.10-2

1.14 Distribution System Piping

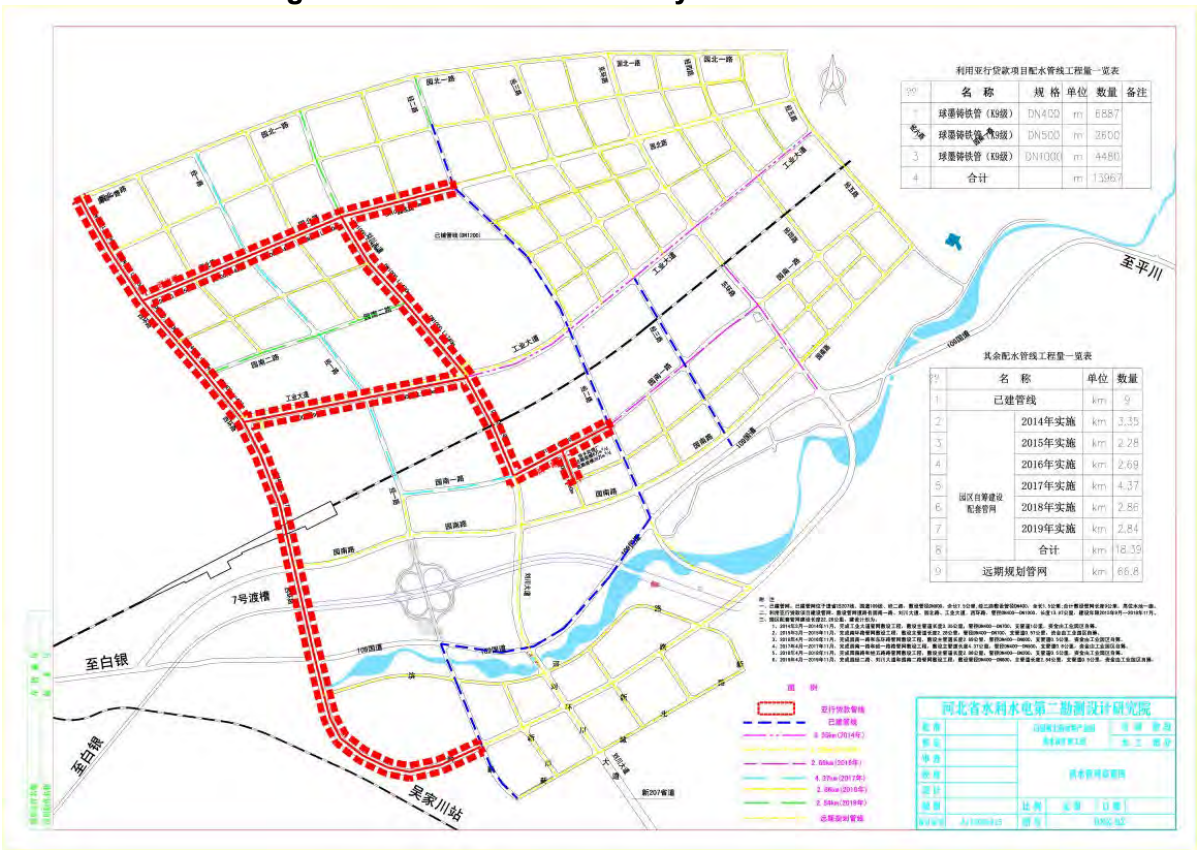
81. Planning for water distribution pipes will coordinate with implementation of the industrial park road network. The total length of the network is 45.23 km of which 13.97 km (31%) of ductile iron pipe will be funded by the ADB Loan. Pipe diameters are: DN400: 6.89 km; DN500: 2.6 km; DN1,000: 4.48 km. Table 21 shows details about the pipeline network and Figure 3 shows the layout of the distribution network with specific pipeline marked funded by ADB investment.

Table 21: Water Supply Pipeline System Plan

Section	Main pipe Length (km)	Branch Pipe (km)	Diameter	Construction Year	Financing Source
Road 207, 109 / Jinger Road	7.5		DN800	Constructed	
Jingsan Road	1.5		DN400	Constructed	
Yuannan No. 1 Road / Liuchuan Avenue / Yuanbei Road / Industrial Avenue / Xihuan Road	13.97		DN400-DN1,000	2015.9-2019.11	ADB
Industrial Avenue Pipeline	3.35	1	DN400-DN700	2014.3-2014.11	Industrial Park
Nanhuan Road Pipeline	2.28	0.57	DN400-DN700	2015.3-2015.11	Industrial Park
Yuannan No. 1 Road / Donghuan Road Pipeline	2.69	0.5	DN400-DN600	2016.4-2016.11	Industrial Park
Yuannan No. 1 Road / Jingyi Road Pipeline	4.37	0.8	DN400-DN500	2017.4-2017.11	Industrial Park
Yuannan Road / Jingwu Road Pipeline	2.86	0.5	DN400-DN500	2018.4-2018.11	Industrial Park
Yuanjing No. 2 Road / Liuchuan Avenue / Yuannan No. 2 Road Pipeline	2.84	0.5	DN400-DN800	2019.4-2019.11	Industrial Park
Total Pipeline System	41.36	3.87			

Source: PMO 23 January 2014

Figure 3: Water Distribution System in Year 2020



Source: Design Institute

Color	Meaning
Dashed Red Square	ADB funded pipeline
Dark Blue Dashed	Pipelines already installed
Violet (east-west)	3.35 km installed 2014 2.65 km installed 2016
Yellow	2.26 km installed 2015 2.86 km installed 2018 Additional as needed (year 2020)
Light Blue (north-south)	4.37 km installed 2017
Green (east-west)	2.84 km installed 2019

1.14.1 Water Distribution Pipeline Material Choice

82. The LDI evaluated pipe materials according to characteristics and costs and concluded:

(a) Less than 400 mm pipes, use flexible pipe (HSPE, PVC)
(b) Between 400 and 1,000 mm pipes, ductile iron pipe is ideal.
(c) All pipes are > DN400 and LDI recommends Ductile Iron, K9 class.

Table 22: Comparison of Distribution Pipe Materials

Number	Contrast item	Steel Skeleton plastic composite pipe	Ductile iron pipe
1	Material	High-density polyethylene / high-strength steel	Cast iron
2	Impact resistance (Brittleness)	Impact resistance performance is good; the elastic deformation of the pipe can be up to 50 ~ 70%, does not easily become brittle.	Poor impact resistance, in case of 2% deformation the pipe cracks, large brittleness
3	Corrosion resistance	Internal and external corrosion protection, excellent corrosion resistance	Need corrosion protection, corrosion resistance poor
4	Hydraulic characteristics	Smooth wall, non-polar material, no scaling, good flow capacity 30% higher than ductile iron pipe	Rough wall, polar material, easy to scale, poor flow capacity

Number	Contrast item	Steel Skeleton plastic composite pipe	Ductile iron pipe
5	Hygiene Performance	Hygienic, non-toxic, no secondary pollution	Poor hygienic performance, secondary pollution possible
6	Wear resistance	Good wear resistance, under the same conditions the wear is only 1/6 that of ductile iron pipe	Poor wear resistance
7	Connection, tightness	Pipes are connected by electric hot melting, never leak, good tightness, overcoming the fatal flaw of ready leakage of ductile iron pipe socket connections, which greatly reduces the leakage rate of the piping system	Pipes are connected by sockets, poor reliability, leak-prone
8	Mass per meter	Light	Heavy
9	Resistance against uneven ground subsidence, underground movement, and end load capacity	Pipe flexible, resistant to uneven settlement of ground strata; when laid underground, can effectively withstand the sudden shock loads due to foundation settlement, sliding, rolling compaction by vehicles; no need for concrete foundation, greatly reducing the foundation treatment costs. Effective resistance against underground movement, the stress relaxation properties of PE can effectively lower the stress through deformation; sufficient end load capacity; the installation does not need expensive anchoring	Owing to use of socket connections, poor resistance to uneven settlement of the ground, underground movement and end loading; easy for pipes to be displaced, causing leakage; concrete foundation must be constructed for pipe installation
10	Construction	Simple construction, low total cost of construction; pipe materials light weight, no need for crane and other equipment. Strong capability to resist uneven ground subsidence, underground movement and end load; requirements for laying not stringent; do not need expensive concrete foundation and anchoring; easy to operate, short construction period relative to ductile iron pipe, low cost	Construction complicated, high total construction cost; pipe heavy weight, cranes and other equipment required to assist handling and connection; poor capability to resist uneven ground subsidence, underground movement and end load, requirements for laying stringent; need expensive concrete foundation and anchoring; complicated to operate, long construction period, high cost
11	Life	50 years	25 years

Source: FSR Table 5.1.2.8-7: Comparison of pipes

Table 23: Cost Comparison of Different Pipe Materials

[price in CNY/m, 2013]

Size (mm)	DIP pipe (K9)	PVC-M	PE
DN400	460	840	1,008
DN500	640	1,320	1,560
DN800	----	3,360	----
DN1,000	2,000	----	4,320

Source FSR Table 5.1.2.8-8

1.14.2 Pipe Wall Thickness

83. Pipe wall thickness is calculated according to GB50332-2002 "Water Supply and Drainage Piping Design Specifications" and the results summarized in Table 24.

Table 24: Pipe Wall Thickness Calculation for DN1200 Steel Pipe

Stake range		Pipe inner pressure (MPa)	Thickness (mm)
Start	End		
0-265	0+000	0.6	16
0+000	2+105	2.0	20
2+105	3+040	1.6	18
3+040	4+540	2.0	20
4+540	8+825	1.6	18
8+825	13+000	1.0	16
13+000	14+285	0.6	16

Source: FSR Table 5.1.2.9-6
mm = millimeter; MPa = Mega-Pascals

84. According to the specification requirements, additional 2 mm is added for corrosion protection.

1.14.3 Pipe Construction

85. In accordance with “Architectural Design Code for Fire Protection” GB50016-2006 below-ground fire hydrants will be along the main pipelines and spaced not more than 120 meters.

86. Pipes will be installed by the trench excavation method (cut and cover).

87. The system will be operated such that the minimum water pressure will be 0.28 MPa. Ultrasonic flow meters with smart pressure transmitters will be installed on the pipelines.

1.15 Water System for Fire Protection

88. The fire water system is consolidated with the treated water distribution system. PRC standard GB50016-2006 "Architectural Design Code for Fire Protection" specifies that the water supply pipe network pressure should ensure that the most negative point of an outdoor fire hydrant water pressure is not less than 10 m water column, i.e. 0.10 MPa. The LIP water distribution system is designed to provide a system pressure of 0.28 MPa, sufficient to serve a six-floor building without additional pumping. Outdoor fire hydrants are designed in accordance with PRC standard GB50013-2006 "Outdoor Water Supply Design Specifications" with spacing 120 m and on pipe of diameter not less than DN100. The 20,000 m^3/d in the water treatment plant clear well (see section 1.10.4) serves as storage reservoir.

1.16 Emergency Operations

89. Under China Law, all Water Supply Companies are required to have an emergency response plan covering for example natural disaster, flooding, water source flow and quality disruption, earthquake.

90. For this report Emergency Management is defined as activities taken to mitigate against, prepare for, respond to, and recover from natural or man-made disasters that may threaten the system’s ability to deliver reliable water supply. This section focuses on activities of design, planning, equipment, and operations.

1.16.1 Design and Equipment for Emergency Operations

91. The design of the water supply system includes redundancies (additional or duplicate systems and equipment that can function in case an operating part or system fails) such as

- Stand-by pumps shown in Table 20
- Typically a water supply system has stand-by generators for electrical outages but LMC is providing dedicated power lines from the transformer station to the water treatment plant so no stand-by generators are required.
- Computer monitoring stations (two for mutual hot standby)

92. Other design safety features include:

- protections for over current, over-voltage, and storm lightning
- video surveillance, emergency lighting system
- powdered activated carbon dosing system as an adsorbent for removal of color, taste and odor compounds, organic pollutants such as pesticides.

1.16.2 Planning and Operations for Emergency Situations

93. Planning and Operations. The facility must have an emergency response plan. This can be included in the technical specifications for the water system infrastructure as a requirement for the contractor to provide emergency response equipment (e.g. for chlorine leak, for fire) and electronic and hard copies of operations and maintenance manuals which include actions to take during an emergency situation.

1.17 Design Standards Used for Water Supply Infrastructure

Chinese Seismic Zoning Map	GB18306-2001
Surface Water Environmental Quality Standard	GB3838-2002
Design Of Masonry Structures	GB50003-2001
Building Foundation Design Code	GB50007-2002
Structural Load Code	GB50009-2001 (2006 edition)
Reinforced Concrete Structural Design Specification	GB5001-2002
Design Of Concrete Structures	GB50010-2002
Seismic Design Of Buildings	GB50011-2001 (2008 edition)
Outdoor Water Supply Design Specification	GB50013-2006
Outdoor Drainage Design Specifications	GB50014-2006
Architectural Design Code For Fire Protection	GB50016-2006
Geotechnical Engineering	GB50021-2001 (2009 edition)
Outdoor Water Supply, Sewerage, Gas And Heating Engineering Seismic Design	GB50032-2003
Architectural Lighting Design Standards	GB50034-2004
Industrial Building Corrosion Resistant Design Specifications	GB50046-2008
Supply And Distribution System Design Specifications	GB50052-2009
Universal Electrical Equipment Distribution Design Specifications	GB50055-93
Water Supply And Drainage Engineering Structural Design Specifications	GB50069-2002
Civil Thermal Design Specifications	GB50176-93
Flood Protection Standards	GB50201-94
Masonry Construction And Acceptance Of Norms	GB50203-2002
Concrete Structure Construction And Acceptance Of Norms	GB50204-2002
Steel Construction Quality Inspection Norms	GB50205-2001
Roof Engineering Technical Specification	GB50207-2004
Construction Seismic Classification Standards	GB50223-2008
On-Site Equipment, Industrial Pipe Welding Construction And Acceptance Of Norms	GB50236-98
Building Water And Heating Engineering Quality Acceptance	GB50242-2002
Foundation Engineering Construction Norms	GB50252-2002
Pumping Station Design Specification	GB50265-2010
Water Drainage Construction And Acceptance Of Norms	GB50268-2008

Water Drains Engineering Design Specifications	GB50332-2002
Drinking Water Health Standards	GB5749-2006
Drinking Water Quality Standards	GJ3020-93
Automation Instrument Selection Design Requirements	HG20509-2000
Urban Water Supply Project Construction Standards	120-2009
Water Supply And Drainage Basin Structure Of Reinforced Concrete Design Procedures	CECS138:2002
Water Supply And Drainage Buried Steel Pipeline Design Specifications	CECS141:2002
Water Paint Composite Pipe	CJ/T120-2008
Urban Water Quality Standards	CJ/T206
High Turbidity Water Supply Design Specification	CJJ40-91
Urban Water Supply Pipe Network Leakage Control And Assessment Standards	CJJ92-2002
Water Diversion Project Design Guidelines	SL430-2008
Water Resources And Hydropower Engineering Classification And Flood Standard	SL252-2000

Source: FSR

1.18 Factors Affecting Construction

94. Climate and Weather: The climate is temperate and arid. Average annual maximum temperature is 16.2℃ and average annual minimum temperature is -13.7℃. Average annual precipitation is 153.1 mm while average annual evaporation is 1,657.1 mm. Maximum depth of frozen soil is 93 cm and typical maximum snow depth is 10 cm. Perennial dominant wind direction is northeast.

95. Geotechnical and hydro-geologic situation: Basic seismic intensity is Degree VII – VIII. Groundwater varies from deep to shallow (4 to 8 meters depth) and is corrosive to steel.

96. Due to weather conditions there is generally no outdoor construction planned from first December to end February.

1.19 Staffing Requirements

97. According to the FSR:

- the Water Supply Company will have a staffing of 40 people (see Table 25)
- the primary water purification plant will have a staffing of 36 people, and
- the secondary water purification plant will have a staffing of 45 people.

Table 25: Estimated Staffing Requirements of Water Supply Company

Job category	Job Title	Staffing (person)
Person in charge	Person in charge	2
	Technical director	1
Integrated management	Administrative services and management	2
	Secretarial and file management	1
	Personnel, labor and education	2
	Safety management	1
Technology management	Person in charge of engineering and technology management	2
	Engineering and technology management of trunk channels	5
	Engineering and technology management of diversion gates	2
	Information and automation management	2
	Planning and statistics management	1
	Water quantity and water quality management	3
	Scheduling Management	2
Financial and asset management	Person in charge of financial and asset management	1
	Financial and asset management	1
	Accounting	1
	Cashier	1
	Water tariff collection	3
Monitoring audit	Monitoring audit	2
Water management	Water management	3
Auxiliary type	Auxiliary management	2
Total		40

Source: Table 5.1.2.11-1 in a previous version of FSR

Table 26: Estimated Staffing Requirements of Water Treatment Plants

	Facility	
Job Title	Primary WTP	Main WTP
Person in charge of operation	2	2
Technology management	2	4
Chlorination and chemical dosing	12	12
Water Treatment operation	8	8
Laboratory technician	2	4
Machine repair	2	4
Patrol	5	8
Others	3	3
Total	36	45

Source: Table 5.1.2.11-2 in a previous version of FSR

98. All positions are skilled.

99. Maintenance and repair staffing in the preliminary WTP will be responsible for the 14.3 km water transmission pipelines and patrol officers from the secondary WTP will be responsible for the 52 km water distribution pipeline system within the LIP.

1.19.1 Private Sector Participation

100. It is proposed to get a private company to operate and maintain the LIP water supply and wastewater systems. This form of Private Sector Participation (PSP) would be a maintenance service contract for the infrastructure. Details are in elsewhere in the report.

101. The tendering documents will include a requirement to submit a staffing plan and that can be one of the criteria for the technical evaluation of bids received.

1.19.2 Training for Water Sector Staff

102. Types of training needed are: (1) fundamentals; (2) technical work skills; (3) technical planning and scheduling; and (4) management and leadership.

103. The Technical Vocational Education and Training (TVET) component of the ADB Project is preparing facilities, equipment, and curriculum. TVET is an excellent method of training because it will be at or close to the LIP and because it can be adjusted to fit the specifics of the LIP infrastructure.

1.20 Implementation Schedule

104. The water supply infrastructure construction is planned to begin Q3-2015 and complete Q3-2019.

Table 27: Water Supply Project Implementation Schedule

NO.	Project Items	2015		2016				2017				2018				2019			
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
A	Construction Preparation																		
B	Construction Diversion																		
C	Main Construction																		
1	Pipeline through Dasha river																		
2	Pump station slope																		
3	Water Transmission Pipelines																		
4	Intake Pump Station																		
5	Primary Pump Station																		
6	Secondary Pump Station																		
7	Preliminary WTP																		
8	Secondary WTP																		
9	Electric Installation																		
10	Water Distribution Pipelines																		
10	Pipeline pressure test																		
D	Project Completion																		

1.21 Procurement Packaging

105. Details are in the Procurement Plan in the Project Administration Manual (PAM). Nine contracts are planned: 7 National Competitive Bidding (NCB), all Civil Works construction and 2 International Competitive Bidding (ICB) one for Civil Works and one for Goods.

106. Pipe procurement and installation is combined into one package, classified as either Civil Works or Goods. This avoids conflicts likely to arise when one contractor is responsible for providing materials that another contractor will install, for example defects in materials, delay in delivery etc. In selecting between Civil Works and Goods consider that the ADB Loan proceeds pay 60% to 65% of the cost of Civil Works but 100% of the cost of Goods.

107. Installation of water supply pipeline needs coordination with road construction to avoid unnecessary excavation of newly completed roads.

1.22 Estimated Costs for Water Supply Component

Table 28: Water Supply Estimated Cost

No.	Cost Item	CNY (10,000)	Proportion (%)
1	Construction and installation costs	41,483.25	79%
2.1	Land acquisition and resettlement costs	2,800.73	5%
2.2	Other expenses	3,445.05	7%
3	Preparation costs	4,772.90	9%
4	Initial working capital	110.00	0.2%
5	Total investment costs	52,611.93	100%

Source: FSR Table 10-5

108. This table does not include Interest during Construction (IDC) which is a weighted average of the ADB Loan (2.5% per annum) and domestic bank loans (6.55% per annum).

1.23 Assessment

109. The water source is considered reliable based on evaluation of Yellow River flow and water quality.

110. The design and sizing of the intake, transmission pipe, two-stage treatment scheme, and pump stations (raw water, transmission, and distribution) are reasonable and appropriate for the local conditions.

111. The water treatment process (sedimentation, filtration, disinfection) is appropriate for Yellow River water at this location. There is no need for treatment processes used by locations much further downstream (e.g. Zhengzhou) which must deal with higher concentrations of pollution.

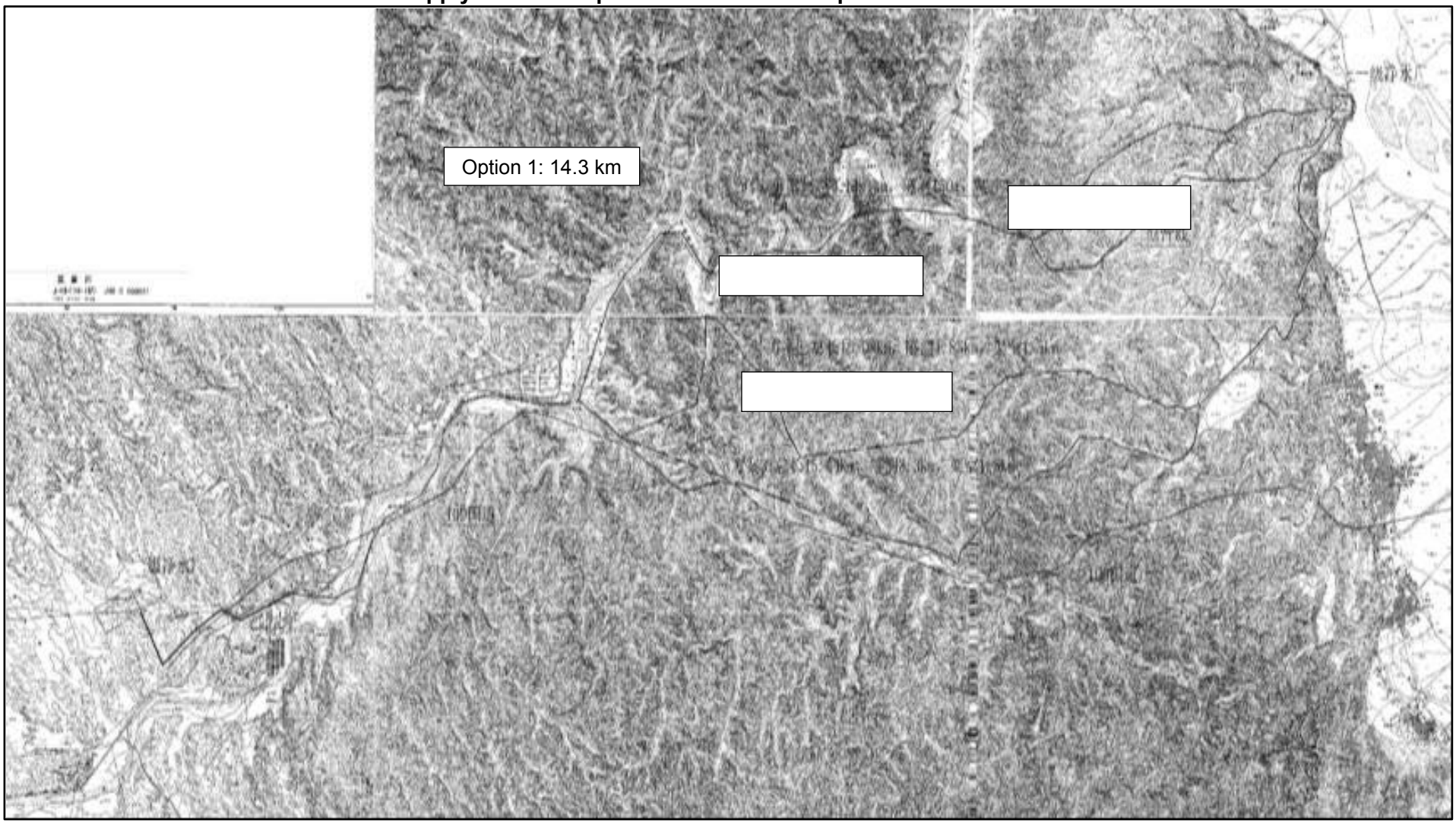
112. Different industries have different water quality requirements. For example the power plant cooling water can come from water treated only by sedimentation; there is no need for filtration. Using less than fully treated water reduces the WTP operating costs. LDI has considered this by including withdrawal points at the inlet to the WTP and between the sedimentation basins and the filters.

113. Wastewater reuse is planned and the pipelines carrying reused water will be kept separate from the potable water pipelines.

114. With the increase from 60,000 m^3/d treated water in year 2020 to 200,000 m^3/d in year 2030, the LDI has planned the site layout to accommodate expansion and to obtain in advance the right-of-way for additional pipelines.

115. The construction of the water distribution system will proceed as industries are established and as much as possible should try to maintain a ring (loop) system to avoid dead-ends.

Water Supply Annex 1: Options Evaluated for Pipeline Transmission Route



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Water Supply Annex 2: Vocational Education for the Water and Wastewater Sector

Introduction

1. The Gansu Baiyin Integrated Urban Development Project Preparatory Technical Assistance (PPTA) includes a component for Technical and Vocational Education and Training (TVET), which focuses on preparing the work force for the Industrial Park.

2. The water and wastewater sector in Baiyin Municipality can benefit from vocational training for its staff. Many of the training courses would be the same for several different vocations, for example inspection and repair of motors.

Primary Responsibilities of a Water and Wastewater Operator

3. The typical description for these types of positions lists many different job duties but the primary responsibilities are:

- adjusts, inspects, and evaluates treatment processes and equipment to optimize performance, maintain regulatory compliance, and minimize adverse impacts while considering cost, equipment capabilities, environmental impacts, and operation health and safety;
- collects samples, performs routine tests and analysis, and records results; and
- identifies changes in operational conditions and interprets information to implement corrective actions and/or troubleshoot process issues.

Primary Responsibilities of a Water and Wastewater Pipe Network Worker

4. The primary responsibilities of a water and wastewater pipe network worker are:

- locates and repairs pipe bursts and leaks
- inspects, operates, and maintains valves and hydrants
- installs pipes and service connections including pressure testing and disinfection.

Fundamental Skills

5. A W&WW operator must have mathematical and statistical understanding of process operations in order things are going as designed and to identify problems. Thus arithmetic fundamentals and an ability to summarize information on a basic statistical level is a fundamental skill.

6. The operator should have the ability to write a technical report on the facility's process and performance using a pre-defined template, e.g. reply to specific questions; fill in the boxes. These reports provide data to prove compliance with regulations and to make improvements to the operations.

7. The operator needs to enter data into a computer.

8. Both the operator and the pipe network worker need to be able to read and follow maps and engineering drawings showing locations of pipes.

Training Needs

9. Types of training needed are: (1) fundamentals; (2) technical work skills; (3) technical planning and scheduling; and (4) management and leadership.

(1) Fundamentals are arithmetic, basic statistics, and report writing using a pre-made template/form. This should not be a repeat of primary or secondary school but based on specific applications.

(2) Technical work skills needed include:
   a. inspection, operation, maintenance, and repair of mechanical and electrical equipment such as pumps, motors, blowers, mixers etc.
   b. calibration of meters that measure various parameters such as flow, pressure, temperature etc.
   c. installation and repair of water distribution pipelines and wastewater collection system pipelines
   d. installation, inspection, and maintenance of valves and hydrants in the water distribution system
   e. inspection and cleaning of sewer pipelines
   f. occupational safety and health (OSH), for example confined space entry; electrical lock-out etc.
   g. laboratory analysis of water and wastewater
   h. ordering, stocking, and inventorying goods and materials such as chemicals, spare parts, pipes, meters etc.
   i. entering process data and operating condition daily, weekly, and monthly onto a written record and input into a computer [can be combined with many of the above]

(3) Technical planning and scheduling includes
   a. Identifying maintenance requirements from manufacturers' operations and maintenance (O&M) manuals
   b. Setting up a maintenance schedule
   c. Issuing work orders, assigning work, recording what was done
   d. Use of computerized software for maintenance management

(4) Management and leadership training is mostly the same as other businesses with more emphasis on
   a. protecting public health and the environment
   b. regulatory compliance
   c. round-the-clock (24/7) operations
   d. pro-active maintenance management.

Water Supply Annex 3: Economic Analysis of The Water Supply System

A. Introduction

1. The economic analysis is undertaken for the water supply in the Liuchuan Industrial Park (LIP) in Jingyuan County. The economic analysis follows ADB *Guidelines for the Economic Analysis of Projects*, which requires least-cost analysis (LCA) of available project options that consider technical factors, including demand, materials supply, and costs. The LCA ensures each subcomponent / component is optimally designed to meet its goals without unnecessary costs.

2. Based on the Guidelines, each individual subcomponent / component must be economically justified through application of benefit-cost analysis. Thus, the economic rates of return (EIRR) were derived. As the main economic viability measure in the analysis, the EIRR must exceed the economic opportunity cost of capital (EOCC) at 12% to be considered economically viable. The analysis uses the annual discounted cash flow model where benefit streams are matched against cost streams. The model also calculates the economic net present value (ENPV) and provides a summary of the risk and sensitivity analysis. The analysis investigates component / subcomponent risks through probable economic scenarios that include capital and operating cost overruns, reduced benefits over time, and project implementation delay.

B. Least Cost Analysis

3. The water supply system is designed to meet the goals of the project at least cost. The LCA includes all feasible options for a given subcomponent, and considered variations in location, planning horizon, demand and design. A minimum of two alternatives have been assessed for each subcomponent based on the technical options. LCA ensures each subcomponent is optimally designed to meet its goals without unnecessary costs.

4. Because of the limited measurable subcomponent outputs for the project, the lowest present value of economic cost (PVEC) approach is adopted in determining the least cost alternative among the technical options. The present value of incremental investment and O&M costs are calculated using the economic discount rate at 12%, and the option with the lowest PVEC is the least cost alternative. Cost analyses are derived from a comparison of “with” and “without project” components. **Table 1** summarizes the options and the results of LCA using PVEC. The least cost option is also the design institute’s (DI) recommended option.

Table 1: Results of Least Cost Analysis Options for All Components

Subcomponent	Item	Option	Least cost option	Recommended by the DI
Water supply	Pump series	Option 1: Single-stage	√	√
		Option 2: Double-stage		
	Water distribution pipeline	Option 1: DIP	√	√
		Option 2: PVC-M		

C. Economic Evaluation

5. Economic viability is measured in terms of EIRR, which should be greater than the opportunity cost of capital. A critical sensitivity analysis will complete the cost-benefit analyses (CBA) considering the impacts of alternative assumptions, risks and imponderables. The CBA follows standard ADB guidelines on economic analysis of subprojects.

C.1 Assumptions

6. Costs and benefits are in March 2014 prices. Financial costs of foreign components are adjusted to their economic values using shadow exchange rate factor (SERF) at 1.01. The shadow wage rate factor (SWRF) for unskilled labor is assumed at 0.67. Unskilled labor comprises 30% of labor cost. Conversion factor for skilled labor and non-traded is at 1.0. Taxes and duties are excluded. CBA uses the discounted cash flow method where cost and revenue streams are compared and discounted using the EOCC. EOCC applies ADB standard at 12%. The cash flows are in real prices and inflationary effects are excluded. CBA covers a 25-year period starting at 2015.

C.2 Economic Costs

7. To reflect costs from the standpoint of the economy, taxes and duties, price inflation and market distortions, where any, are excluded from the financial costs and these are converted into economic costs using a domestic price numéraire. Both the project capital cost and the operation and maintenance (O&M) cost are distributed into traded and non-traded components and labor.

8. **Water Supply.** The water supply subcomponent will finance source development designed to provide 60,000 m^3/d, 14.3 km of transmission pipeline, and 13.9 km of distribution pipeline. The financial capital cost is estimated at CNY499.51 million excluding price contingency. The foreign currency portion accounts for 15% of the total. The economic capital cost amounts to CNY407.60 million as shown in **Table 5.**

Table 5: Economic Cost Conversion – Water supply subcomponent

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Rate
Civil Works	CNY million	339.36	272.67	0.80
Materials & Equipment	CNY million	65.07	58.40	0.90
Engineering	CNY million	21.47	16.79	0.78
Consultants	CNY million	2.70	2.74	1.01
Land, Resettlement	CNY million	25.50	19.94	0.78
Base Cost	CNY million	454.10	370.54	0.82
Physical Contingency	CNY million	45.41	37.05	0.82
Total Cost	CNY million	499.51	407.60	0.82

9. O&M costs for water supply include personnel salaries, chemical treatment, power and fuel, maintenance and miscellaneous materials. Details of economic capital and O&M costs are given in **Table D-1 and D-2**.

C.3 Economic Benefits

10. For water supply, the benefits include beneficiary willingness-to-pay for improved and expanded (incremental) water service, improved health, and user resource savings. The willingness-to-pay price has been derived from the social survey that covered domestic and non-domestic users. Domestic tariffs are subjected to user affordability analysis to ensure tariff acceptability and subcomponent sustainability.

11. The water supply facilities of the project will reduce the total economic cost of obtaining water for each household and enterprise. Water supplied by the project will replace water used by Gansu Rare Earth Company (GREC) and the existing households (non-incremental demand), and will enable LIP's enterprises and households to increase their consumption (incremental demand). The project is projected to replace most of the private water supplies currently used by the enterprise and households.

12. Resource cost savings are estimated by multiplying the quantity of water consumed without the project, i.e. non-incremental quantity, by the average economic supply price in the

without project situation. Considering new water supply plants will replace the old water supply facility that services GREC and households nearby, the savings estimate is based on the water consumption of the enterprise and the households with the economic price.

13. The value of incremental water is based on the average willingness-to-pay as a proxy for the demand price of water of the project. The demand price of water without the project is the financial demand price of the various alternative sources. The average demand price of water with the project is based on the average willingness-to-pay as proxy for the demand price of water, which averages CNY2.52 per m^3 for domestic consumption and CNY4.10 per m^3 for commercial and industrial usage. The total value of non-incremental and incremental water makes up the gross total economic benefits of the water supply subcomponent.

D. Results of Economic Evaluation

14. **Economic internal rate of return.** The EIRR is derived for the individual components / subcomponents and consolidated for the project as a whole. The EIRR for the component / subcomponents range between 15.7% and 23.7%. The EIRR for the project as a whole is **16.3%**. For the LIP component, the overall EIRR is 14.5%. The proposed investments are therefore economically justified individually and when consolidated as a whole with the EIRR higher than the economic opportunity cost of capital (EOCC) at 12%.

15. **Sensitivity and risk analysis.** Sensitivity analysis is carried out for the individual components / subcomponents and for the project as a whole. Sensitivity scenarios investigated include (i) 10-20% increase in capital investment, (ii) 10-20% increase in O&M cost, (iii) 10-20% increase in combined capital and O&M costs, (iv) 10-20% reduction in benefits, (v) combined (iii) and (iv), and (vi) delay in project or component / subcomponent implementation by one year. The sensitivity analysis shows the individual components / subcomponents and the consolidated project remaining robust except water supply under a combined benefit reduction and increase in total costs. Overall, the project is likewise most sensitive to the combined reduced benefit and increased costs. The results of the individual EIRR and sensitivity analyses are given in **Table D-3** for water supply.

Table D-1: Economic Investment Cost – Water Supply

Components	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 30%	Balance Local Cost	Taxes 17%	Other Costs	Foreign x SERF 1.01	Unskilled x SWRF 0.67	Other Cost x 1.00	Economic Project Cost
Civil Works	166.35	15.47	150.88	45.26	105.61	17.95	87.66	15.67	30.33	87.66	133.66
Materials & Equipment	62.68	31.34	31.34	9.40	21.94	3.73	18.21	31.75	6.30	18.21	56.26
Survey, Design, Supervision	12.47	-	12.47	3.74	8.73	1.48	7.24	-	2.51	7.24	9.75
Consultants	2.70	2.70	-	-	-	-	-	2.74	-	-	2.74
Land	1.00	-	1.00	0.30	0.70	0.12	0.58	-	0.20	0.58	0.78
Base Cost	245.20	49.51	195.69	58.71	136.98	23.29	113.69	50.16	39.33	113.69	203.19
Physical Contingency	24.52	4.95	19.57	5.87	13.70	2.33	11.37	5.02	3.93	11.37	20.32
Total Cost	269.72	54.47	215.26	64.58	150.68	25.62	125.06	55.18	43.27	125.06	223.51

Table D-2: Economic O&M Cost – Water Supply and Sanitation

Particulars	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Water Supply	1.16	1.19	1.23	1.27	1.30	1.34	1.38	1.42	1.47	1.70	1.97	2.29
Salaries	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.15	0.18	0.21
Power	0.66	0.68	0.70	0.72	0.74	0.76	0.78	0.81	0.83	0.96	1.12	1.29
Treatment	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Maintenance	0.32	0.33	0.34	0.35	0.36	0.37	0.39	0.40	0.41	0.47	0.55	0.64
Miscellaneous	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.09	0.11
Distribution pipelines	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Wastewater	0.81	0.83	0.86	0.88	0.91	0.94	0.97	0.99	1.02	1.19	1.38	1.60
Salaries	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08
Power	0.26	0.27	0.28	0.29	0.30	0.31	0.31	0.32	0.33	0.39	0.45	0.52
Treatment	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.16	0.18
Maintenance	0.33	0.34	0.35	0.36	0.37	0.38	0.40	0.41	0.42	0.49	0.56	0.65
Miscellaneous	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.07
Collection pipelines	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.09

Table D-3: EIRR and Sensitivity Analysis – Water Supply

Year	Benefits				Costs			Net Inflow (Outflow)						
	Total	Resource Cost Savings	Incremental Consumptn	Improved Health	Total	Capital	O&M	Base Case	Cap Cost + 10%	O&M Cost + 10%	Total Cost + 10%	Benefit - 10%	Benefits - Total Cost + 10%	Delay by 1-year
2015	-				77.77	77.77		- 77.77	- 85.55	- 77.77	- 85.55	- 77.77	- 85.55	- 77.77
2016	-				130.96	130.96		- 130.96	- 144.05	- 130.96	- 144.05	- 130.96	- 144.05	- 130.96
2017	-				215.16	215.16		- 215.16	- 236.68	- 215.16	- 236.68	- 215.16	- 236.68	- 215.16
2018	-				132.97	132.97		- 132.97	- 146.26	- 132.97	- 146.26	- 132.97	- 146.26	- 132.97
2019	-				74.24	74.24		- 74.24	- 81.67	- 74.24	- 81.67	- 74.24	- 81.67	- 74.24
2020	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	- 26.13
2021	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2022	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2023	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2024	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2025	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2026	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2027	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2028	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2029	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2030	171.62	21.61	149.93	0.08	140.79	114.66	26.13	30.83	19.37	28.22	16.75	13.67	- 0.41	30.83
2031	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2032	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2033	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2034	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2035	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2036	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2037	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2038	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2039	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2040	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
EIRR								15.7%	14.4%	15.5%	14.2%	14.0%	12.5%	13.5%
ENPV	736	163	1,134	1	584	512	198	152	105	141	94	78	20	65
Sensitivity Indicator														
EIRR									3.54	0.68	4.20	4.63	8.71	2.90
ENPV									3.11	0.74	3.85	4.85	8.69	2.77
Switching Value														
EIRR									0.28	1.46	0.24	0.22	0.11	0.34
ENPV									0.32	1.36	0.26	0.21	0.12	0.36

Water Supply Annex 4: Least Cost Analysis

1. Background and Summary

1. In the feasibility study report (FSR), the local design institute (LDI) proposes a number of alternative options of the sites, road pavement materials, water and wastewater treatment processes, pipeline materials, pumping series numbers etc.

2. The LDI weighs the options against each other in terms of technological advantages and convenient construction and easy management. ADB further requires the least cost options are identified, which is taken into consideration in selection of options.

Table F-1: The Scope and Characteristics of components / subcomponents

Component / subcomponent	Characteristics
Water supply	Capacity 60,000 m^3/d, transmission pipeline 14.4 km, distribution pipeline 13.97 km

3. The TA Consultants evaluated all the options identified by the LDI in view of engineering and technology. The LDI and TA Consultants have analyzed in detail the contents of this component. There are no other engineering options; the component's cost effectiveness depends on the rationality and advantages of the content and scheme. **Table F-2** lists the options on which LCA has been carried out. There are more options in the FSR than what are listed. These options are chosen due to their overwhelming technological merits, thus no LCA has been carried out for them.

Table F-2: Options for least cost analysis

Subcomponent	Item	Option
Water supply	Pump series	Option 1: Single-stage Option 2: Double-stage
	Distribution pipeline	Option 1: DIP Option 2: RCP

RCP = reinforced concrete pipe; DIP = ductile iron pipe;

4. The LCA results are summarized in **Table F-3.**

Table F-3: Summary of the results of the least cost analysis

Subcomponent	Item	Option	Least cost option	Recommended by the DI
Water supply	Pump series	Option 1: Single-stage	√	√
		Option 2: Double-stage		
	Water distribution pipeline	Option 1: DIP	√	√
		Option 2: PVC-M		

2. Methodology, General Parameters, and Assumptions

Methodology

5. Based on the ADB Guidelines on Least Cost and Cost Effective Analysis, there are three different methodologies to perform LCA and they are as follows:

(i) the lowest average incremental economic cost (AIEC);
(ii) the lowest present value of economic costs (PVEC); and
(iii) the equalizing discount rate (EDR).

6. The lowest AIEC and EDR approaches are both adopted for those components whose outputs are measurable (say flow/day). The lowest PVEC approach is chosen when a measurable output is not available. For this project, the measurable outputs of the

subcomponents are limited and therefore the lowest PVEC approach has been adopted. All cost analyses are derived from a comparison of "with" and "without project" components with a discounted rate of 12% per annum. The PVEC equalizes the present value of capital investment and O&M costs.

Project Specific Conversion Factors

7. The cost estimates have been broken down for each of the subcomponents in accordance with ADB guidelines for economic analysis, i.e. the capital costs together with O&M costs. The costs have been further divided into skilled labor, unskilled labor, traded goods, non-traded goods, and taxes. The conversion factor (CF) for each of the cost items has been calculated. The CFs will then be applied to the LCA and economic analysis. The entire life cycle of financial costs of the current designs proposed in the FSR and the life-cycle financial costs of alternatives are converted into economic costs. The CFs of various cost categories are given in **Table F-4.**

Table F-4: Summary of Project Specific Conversion Factors

Component	Category	CF
Water Supply	Civil Works	0.8688
	Equipment	0.8581
	Associated engineering cost	0.9888
	O&M Cost	0.8569

Note: TA Consultants' Estimates

8. In addition to the above CFs, other relevant parameters are shown in **Table F-5**.

Table F-5: Other Parameters

Item	Parameter	Source
Shadow Exchange Rate Factor (2003)	=1.0131	ADB guideline
Skilled Labor	=1.0 in domestic price	National guideline
Unskilled Labor	=0.67 in domestic price	National guideline

Note: The parameter assumptions originate from the PRC's national guideline on methodology and parameters for construction projects' economic assessment.

9. Assumptions

(i) LCA only applies to engineering alternatives.
(ii) Under normal operation, the O&M cost is constant in the economic analysis.

10. General Parameters

(i) All estimates are in 2013 prices.
(ii) The economic discounted rate is 12%.
(iii) The period of analysis for each subcomponent includes the construction period and life span of the subcomponent. The life span for each subcomponent is taken as 20 years and the construction period is between 2 and 4 years for different subcomponents.
(iv) Value added taxes for non-tradable and tradable goods are all 17%; customs duty for tradable goods is zero; business tax for construction companies and transport enterprises is 3.44%.
(v) Based on the VAT, 7% is for urban construction maintenance fee and 3% is for education fee.

11. The costs for capital investment and operation/maintenance are estimated by the LDI and have been adopted here as the financial cost for least-cost comparison purposes.

12. Generally, if the LCA can derive capital and O&M costs directly in the portion of changes for the compared options, the results of LCA for compared options will show individual

differences more obviously. The DI estimates costs separately in accordance with subprojects. Even the engineering cost of direct construction (say first part cost) can be divided into different construction items (such as treatment works of water supply and water distribution pipe network). The costs by technical option for the compared contents of LCA cannot be completely separated; especially the cost of land acquisition and compensation, included in "the project's other expenses" (say second part cost) generally assessed for one by one subproject. It is difficult to separate this cost in accordance with different construction items.

13. Similarly, O&M estimates are generally required in accordance with the subproject level to forecast the labor quota, water, electricity and materials consumption, maintenance costs and other estimates. It is difficult to estimate O&M costs in accordance with the compared technical options separately for LCA. Therefore, the following LCA were presented with the total cost of each subproject, which includes the cost changes for the compared options.

3. Alternatives Options identified for Least Cost Analysis

14. The FSR submitted by the LDI has preliminarily identified and evaluated engineering alternatives based on technical analysis. Some comparisons of engineering characteristics and static unit costs such as for per 100 meter pipeline have been conducted for the subcomponents in the FSR. The TA Consultants have proposed alternatives for LCA based on internal discussions as well as discussion with the LDI.

15. According to ADB's guideline of economic analysis, LCA should be carried out for each subcomponent. The TA Consultants prepare a list of alternatives for LCA.

(1) Location selection

16. Natural and geographical conditions determine the water intake location. The subcomponent involves two levels of the water purification plant. Selection criteria for the water intake location are that the sites of the plants should be close to the water intake, the water transfer pipeline should be short, with not much land required and good construction conditions. Besides, the proximity to the water distribution network is an important factor in site optimization. In accordance with the above principles, combined with the master plan of LIP, the FSR recommended a site in the southeast corner of Yuannan 1 road and Jing 2 road, covering 150 mu.

17. The TA Consultants agree with the FSR on the recommended engineering options after site visit. Therefore, there is no need for further detailed LCA.

(2) Selection of water transfer pipeline alignment

18. The options are as below:

- Option 1: Westward along a valley layout to Dasha River, and then northward, with a total pipeline length 14.3 km, and a 205 m long tunnel
- Option 2: Southward along a valley to Xiaochuan, and then westward along Toudaogou Valley, with a total pipeline length of 16.08 km, and a 1.85 km long tunnel
- Option 3: Southward along a valley to south of Xiaochuan, and then to the end of Erdaogou, with a total pipeline length of 15.44 km, and a 3.32 km long tunnel

19. Results of the technical and economic analysis for the above three options are shown in **Table F-6.**

Table F-6: Comparison of Civil work investment of different options (Unit: CNY1,000)

Item	Option 1	Option 2	Option 3
Earth excavation	746.42	868.95	845.68
Rock excavation	276.17	120.34	48.14
Earth backfill	994.18	1,120.31	1,073.52
Mountain stonework	417.31	787.49	386.62
Sand cushion	268.78	316.54	303.94
Valve well	11.1	13.8	13.2
Steel elbow	384.16	470.60	451.39
Steel pipe	5,312.10	6,169.31	5,923.76
Corrosion protection outside PE	124.17	144.20	138.46
Corrosion protection inside PE	100.71	116.96	112.30
Temporary land (cultivated field)	299.99	336.46	323.07
Temporary land	317.07	355.61	341.45
Permanent land	46.60	57.93	55.41
Tunnel	1025	9712.5	17430
Total	10,323.74	20,590.98	27,446.95

20. It is obvious that option 1 has the advantage in investment; it represents a saving of more than 50% compared with option 2 or option 3. While different options have advantages and disadvantages regarding the convenience of construction and operation, option 1 is obviously the best and is thus recommended. No LCA is necessary.

(3) Choice of pressuring pump series

21. With a long water transfer pipeline between the first level and second level water purification plants, and large terrain changes, pumping is one of the key engineering issues.

22. The feasible engineering options are as below:

Option 1: Single-stage pressurized pump station
Option 2: Double-stage pressurized pump station

(4) Water purification process optimization

23. This subcomponent adopts two levels of plants. The first level plant is necessary due to high turbidity of the Yellow River raw water. The FSR considered 1-level, 2-level and 3-level sediment sinks options, and recommended the 2-level sediment sinks option with reference to other water purification plants along the Yellow River nearby. The 2-level plant adopts a normal and conventional process.

(5) Selection of water transfer pipeline materials

24. For water transfer pipeline, steel pipe and ductile iron pipes are the conventional materials used in the PRC. The steel pipe's material cost is higher, but it has good adaptability to complex terrain and high water hammer. In Gansu province, it has been successfully used in various high-lift pumping stations. Therefore, from engineering safety considerations, the FSR recommended the steel pipe material.

(6) Selection of water distribution pipeline materials

25. For water distribution pipeline, some materials such as ductile iron pipe (DIP), reinforced concrete pipe (RCP) and PE pipe are applied very widely. As PE pipe cannot be adapted to the cold weather of Northwest China, the options chosen for LCA are as below:

Option 1: DIP

Option 2: PVC-M

4. Least Cost Analysis

4.1 Water supply subcomponent: Pump series

26. Two alternatives have been considered as LCA options, the single-stage and double-stage pumping. The options are as follows.

Option 1: Single-stage pumping

27. This option involves only one water booster pump station in the first level purification plant. The pumping station is designed to lift water up to 146 m. It is equipped with three sets of horizontal single-stage double-suction centrifugal pumps, with two operating and one standby. The pump station house size is 30 m × 9.6 m (length × width), the floor thickness 0.5 m, and sidewall thickness 0.5 m.

28. The single-stage pump option needs to set up three surge tanks ahead of the pipeline of the secondary purification plant. The surge tanks adopt reinforced concrete structures, with an inner diameter of 7 m, wall thickness of 0.5 m, and height of 10 m.

Option 2: Double-stage pumping

29. This option involves two pumping stations. One station is located in the first-stage purification plant. The first pumping station is located in first-class purification plant.

30. This pumping station's design lift water head is 63 m. It is equipped with three sets of horizontal single-stage double-suction centrifugal pumps, with two operating and one standby. The pumping station size is 26 m × 9.0 m (length × width), floor thickness 0.5 m, and sidewall thickness 0.5 m.

31. The secondary booster pump station is located near 6+500. The pumping head designed is 84 m. This station is equipped with three sets of horizontal single-stage double-suction centrifugal pumps, with two operating and one standby. The size of this pumping station is 28 m × 9.6 m (length × width), the floor thickness 0.5 m, and the sidewall thickness 0.5 m. **Table F-12** presents the options for pump series.

Table F-12: Economic Cost of Water Supply for Pump Series Alternatives (Unit: CNY1,000)

	Cost Category	Option 1: Single-stage			Option 2: Double-stage		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	47,729		35,971	47,877		36,100
1.1	Civil work	19,473	0.8688	16,918	19,635	0.8688	17,059
1.2	Installation	15,504	0.8688	13,470	15,504	0.8688	13,470
1.3	Equipment associated	6,507	0.8581	5,583	6,493	0.8581	5,571
1.4	Engineering cost (excluding IDC)	6,246		6,032	6,246		6,032
1.4.1	Insurance	145	0	0	145	0	0
1.4.2	Others	6,101	0.9888	6,032	6,101	0.9888	6,032
2	Contingency	4773	1	4773	4788	1	4788
3	Start-up working capital	110	1	110	110	1	110
4	Subtotal	52612		40854	52775		40998
5	O&M cost	2256	0.8569	1933	2254	0.8569	1931

32. As shown in **Table F-13**, the two options are very similar in terms of the present value of

economic cost. However, the single-stage pump option has advantages of easy maintenance, convenient operation and marginal saving cost. So the single-stage option is recommended.

Table F-13: Present value of cost of pump series options for water supply (Unit: CNY1,000)

No.	Year	Option 1: Single-stage			Option 2: Double-stage		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	12,256		12,256	12,299		12,299
2	2016	16,342		16,342	16,399		16,399
3	2017	12,256	1,353	13,610	12,299	1,352	13,651
4	2018		1,933	1,933		1,931	1,931
5	2019		1,933	1,933		1,931	1,931
6	2020		1,933	1,933		1,931	1,931
7	2021		1,933	1,933		1,931	1,931
8	2022		1,933	1,933		1,931	1,931
9	2023		1,933	1,933		1,931	1,931
10	2024		1,933	1,933		1,931	1,931
11	2025		1,933	1,933		1,931	1,931
12	2026		1,933	1,933		1,931	1,931
13	2027		1,933	1,933		1,931	1,931
14	2028		1,933	1,933		1,931	1,931
15	2029		1,933	1,933		1,931	1,931
16	2030		1,933	1,933		1,931	1,931
17	2031		1,933	1,933		1,931	1,931
18	2032		1,933	1,933		1,931	1,931
19	2033		1,933	1,933		1,931	1,931
20	2034		1,933	1,933		1,931	1,931
21	2035		1,933	1,933		1,931	1,931
22	2036		1,933	1,933		1,931	1,931
NPV	**12%**			49,049			49,165

4.4 Water supply subcomponent: Distribution pipeline

33. The LDI proposes two types of pipeline, i.e. DIP and mixed pipeline of PVC-M.

Option 1: DIP

34. DIP is made of cast iron with rough interior. It needs corrosion prevention measures. Rubber gasket is used to connect the pieces together; it seals the pipeline very well but has a short economic life. It is easy to install and can support a pressure of 1.2 MPa. The connection is bendable but the pipeline itself is not.

Option 2: PVC-M pipe

35. The PVC-M pipeline is a modified form of PVC. It possesses the advantages of PE; it is elastic and bendable. It also possesses the advantages of UPVC in installation, easy maintenance etc. Each option has its advantages and disadvantages in technical terms. LCA can help the selection. **Table F-14** presents the options for pipe materials.

Table F-14: Economic cost of pipeline materials options for water supply (Unit: CNY1,000)

	Cost Category	Option 1: DIP			Option 2: PVC-M		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	47,729		35,971	50,541		38,414
1.1	Civil work	19,473	0.8688	16,918	19,473	0.8688	16,918
1.2	Installation	15,504	0.8688	13,470	18,315	0.8688	15,912
1.3	Equipment	6,507	0.8581	5,583	6,507	0.8581	5,583
1.4	Associated engineering cost (excluding IDC)	6,246		6,017	6,246		6,017
1.4.1	Insurance	145	0	0	145	0	0
1.4.2	Others	6,101	0.9863	6,017	6,101	0.9863	6,017
2	Contingency	4,773	1	4,773	5,054	1	5,054
3	Start-up working capital	110	1	110	110	1	110
4	Subtotal	52,612		40,854	55,705		43,578
5	O&M cost	2,256	0.8569	1,933	2,437	0.8569	2,088

36. As shown in **Table F-15**, option 1, DIP material, is obviously cheaper than option 2, PVC-M material, by CNY3.436 million and by 6.5% in terms of the economic present value of cost. It is the least cost option and is recommended.

Table F-15: Present value of cost for water supply pipeline materials (CNY1,000)

No.	Year	Option 1: DIP			Option 2: PVC-M		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	12,256		12,256	13,073		13,073
2	2016	16,342		16,342	17,431		17,431
3	2017	12,256	1,353	13,610	13,073	1,462	14,535
4	2018		1,933	1,933		2,088	2,088
5	2019		1,933	1,933		2,088	2,088
6	2020		1,933	1,933		2,088	2,088
7	2021		1,933	1,933		2,088	2,088
8	2022		1,933	1,933		2,088	2,088
9	2023		1,933	1,933		2,088	2,088
10	2024		1,933	1,933		2,088	2,088
11	2025		1,933	1,933		2,088	2,088
12	2026		1,933	1,933		2,088	2,088
13	2027		1,933	1,933		2,088	2,088
14	2028		1,933	1,933		2,088	2,088
15	2029		1,933	1,933		2,088	2,088
16	2030		1,933	1,933		2,088	2,088
17	2031		1,933	1,933		2,088	2,088
18	2032		1,933	1,933		2,088	2,088
19	2033		1,933	1,933		2,088	2,088
20	2034		1,933	1,933		2,088	2,088
21	2035		1,933	1,933		2,088	2,088
22	2036		1,933	1,933		2,088	2,088
NPV	12%			49,049			52,485

SUPPLEMENTARY DOCUMENT 3 B
TECHNICAL ANALYSIS OF WASTEWATER SUBCOMPONENT

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ABBREVIATIONS AND MEASURES

ADB	Asian Development Bank		O&M	Operation and Maintenance
CNY	China Yuan (Chinese currency)		PAM	Polyacrylamide (a flocculant)
DI	Ductile Iron		PMO	Project Management Office
EA	Executing Agency		PPTA	Project Preparatory Technical Assistance
EPB	Environmental Protection Bureau		PRC	People's Republic of China
FSR	Feasibility Study Report		PS	Pumping Station
FYP	Five-Year Plan		PSP	Private Sector Participation
HDPE	High Density Polyethylene		RCP	Reinforced Concrete Pipe
IA	Implementation Agency		RMB	Renminbi (Chinese currency)
ICB	International Competitive Bidding		RoW	Right-of-way
LA	Land Acquisition		TA	Technical Assistance
LCA	Least Cost Analysis		TOR	Terms of Reference
LDI	Local design institute		USD	United States Dollar
LMC	Liuchuan Industrial Park Management Committee		WS	Water Supply
lpcd	liter per capita per day		WWTP	Wastewater Treatment Plant
NCB	National Competitive Bidding			

Measures and Units

ha	hectare = 10,000 square meters		m^3/d	cubic meters per day
km	kilometer = 1,000 meters		m^3/s	cubic meters per second
kw, kwh	kilo-watt; kilo-watt hour		mg/L	milligrams per liter (1,000 mg = 1 kilogram)
L	Liter, 1,000 L = 1 cubic meter		MPa	Mega-Pascal (1 MPa = 10 bar = 100 meters)
Lpcd	liter per capita per day		mu	Chinese unit of land measure; 15 mu = 1 ha
m	meter		T.ds/d	tons dry solids per day
mm	millimeter, 1,000 mm = 1 meter			

1 Wastewater System

1.1 Current Situation and Existing Problems

1. The current wastewater infrastructure is owned by the Liuchuan Rare Earth Company and has a capacity of only 5,000 m^3/d. It treats only industrial process water and operates 24 hours a day.

2. Domestic wastewater from residences in the Rare Earth community drains to a sewer system and farmers diver the wastewater to irrigate their land without treatment.

3. A wastewater treatment system is urgently needed considering the deterioration of the surrounding environment and the increased volume of wastewater that will be discharged by industries planned for the Liuchuan Industrial Park (LIP).

1.2 Plan for Wastewater System

4. Local Government contracted with the Lanzhou Urban Construction Design Institute to prepare the Feasibility Study Report (FSR).

5. The wastewater system for the Liuchuan Industrial Park (LIP) will process (a) sewage from residential dormitories and offices; and (b) wastewater from industries. It will not include stormwater.

6. With a rigorously enforced industrial pre-treatment program, the wastewater will be somewhat stronger than typical domestic wastewater and will meet the industrial wastewater discharge standards in each respective industry.

7. The plan is to collect wastewater discharged by LIP's industries, treat to PRC Class 1A standards (GB18918-2002), and 100% reuse the treated wastewater by industries and for landscape irrigation within the LIP.

8. Wastewater sludge will be dewatered and transferred for landfill. This is discussed further in section 1.9: Wastewater Sludge Processing.

1.3 Service Area

9. The service area is the 23-km^2 planned area of LIP in Jingyuan County by year 2020. Ultimately the LIP will be 100 km^2 of which detailed planning for 50 km^2 is completed. See Figure 1.

Figure 1: Project Location Map

1.4 Wastewater Demand

10. The Local Design Institute (LDI) estimates wastewater demand by considering (a) domestic sewage from the population served and (b) wastewater from the industries located in the IP.

1.4.1 Domestic Wastewater Production

11. Each industry will have residential dormitory buildings for its workers. LDI estimates the Year 2020 population to be 34,000 and year 2030 population at 68,000. The Liuchuan Industrial Park Management Committee (LMC) estimates manpower requirements for year 2030 population to be 86,000. The PPTA Industrial Sector Analysis estimated the population size for LIP at 36,000 to 39,000 in 2020 and between 73,000 and 79,000 in 2030 during the night time and daytime. The population growth is irregular because it depends on when industries start operating.

12. For this analysis use the average of the estimates. For year 2020 the average of 34,000 and 39,000, rounded up, is 37,000. For year 2030 the average of 68,000 and 86,000 and 79,000 rounded up is 78,000.

13. The LDI used 120 liters per capita per day (L/c/d) as the average daily integrated domestic water use and assumed 90% of the planned per capita water consumption will go to the sewer, e.g. bathing, cleaning, and toilet. Then 120 L/c/d x 90% = 108 L/c/d wastewater.

Table 1: Liuchuan Industrial Park Estimated Domestic Wastewater Produced

No.	Parameter	units	2013	2020	2030
1	Liuchuan Township's Urban Population	capita	13,131	37,000	78,000
2	Percent of Population Served	%	40%	100%	100%
3	Water Supply Serving Population	capita	5,300	37,000	78,000
4	Per capita domestic water use	L/capita/day			120
5	Domestic Water Demand (rounded up)	m^3/day	600	4,400	9,400
6	% Domestic Water to Sewer	%			90%
7	Domestic Wastewater (rounded up)	m^3/day	540	4,000	8,500

1.4.2 Industrial Wastewater Production

14. Industrial wastewater is estimated for each industry and summarized in Table 2 for year 2020 and in for year 2030.

Table 2: Industrial Wastewater Production by Year 2020

No.	Enterprise	Area (km^2)	Water Demand (m^3/d)	% to Waste	Wastewater (m^3/d)
1	Gansu Hongtai Aluminum Co.	4	8,000	50%	4,000
2	Gansu Kaisi Ceramics Co Ltd	1.53	1,500	60%	900
3	Baiyin Jiarui Ceramics Co Ltd	0.12	1,000	60%	600
4	Jingyuan Power Plant (replacing existing)	0.8	6,000	20%	1,200
5	Gansu Lantong Power Cables Co Ltd	0.19	200	80%	160
6	Gansu Rare Earth New Materials Shareholding Co Ltd	2.34	8,500	60%	5,100
7	Baiyin Honglu Aluminum Co	3.33	6,000	60%	4,000
8	Gansu Shengyuan Agricultural Produce Storage and Transportation Co Ltd	0.67	500	80%	400
9	Shanghai Zhongjin Logistics	2	3,000	80%	2,400
10	Solar thermal power specialist equipment manufacturing park	Note below			
11	Gansu Hengda Ceramics Co		1,500	60%	900
12	Coal chemical integration project	3.06	12,000	67%	10,000
	Service industry				
13	Education services		No special water use; assume domestic consumption.		
14	Financial services				
15	Culture, sports and entertainment				
16	Water, power, environment, public infrastructure management				
17	Modern logistics				
		18.04	**48,200**	**55%**	**29,660**

Source: FSR Table 5.1.1.3-2, LMC, and TA Consultants
Industries #1, #2, #3, and #6 are already on-site but not full capacity.
Industry #10 will not be within the 23 km^2 LIP.

Table 3: Industrial Wastewater Production by Year 2030
[Total Land Area = 23 km^2]

Land Use	Planned area	Water use index	Water use quantity	Wastewater flow produced
	(km^2)	($m^3/d.km^2$)	(m^3/d)	(m^3/d)
Type 2 industrial	5.5	20,000	110,000	60,000
Type 3 industrial	3.4	30,000	102,000	55,000
Warehouse	3.01	2,000	6,020	4,800
Total (rounded)	11.9	---	218,000	120,000

Source: FSR Table 5.1.1.3-3. $m^3/d.km^2$ = cubic meters per day per square kilometer
For year 2030, LDI estimates 55% of the water used will be discharged as wastewater.
Type I: Industrial land that have no interference and pollution to living environment and public facilities;
Type II: Industrial land that have some interference and pollution to living environment and public facilities;
Type III: Industrial land that have serious interference and pollution to living environment and public facilities

1.4.3 Total Wastewater Production

Table 4: Estimated Total Wastewater Volume for Years 2020 and 2030

	2020		2030	
	m^3/d	% of total	m^3/d	% of total
Domestic wastewater	4,000	12%	8,500	7%
Industrial wastewater	29,700	88%	120,000	93%
Total Water Demand	33,700	100%	128,500	100%

Source: FSR Table 5.1.1.3-4 and TA Consultants
Numbers rounded to nearest 100

1.5 Proposed Infrastructure

Table 5: Proposed Wastewater Infrastructure

No.	Sub-Component	2020	2030
1	Wastewater Treatment Plant	35,000 m^3/d	130,000 m^3/d
2	Wastewater Collection System	46.035 km of DN400 – DN1,200 reinforced concrete pipe	----

Source: FSR, DN = Nominal Diameter, km = kilometer, m^3/d = cubic meters per day

15. The WWTP consists of coarse and fine screenings, aerated grit chamber, primary sedimentation, a regulating pool (basin), secondary treatment process (G-BAF), disinfection, coagulation and filtration, and discharge.

1.5.1 Site Selection for the WWTP

16. LDI used the following principles for WWTP site selection[1]:

(a) Downstream of urban water bodies
(b) Convenient and safe for effluent discharge or reuse
(c) Convenient for centralized processing and disposal of sludge
(d) Downwind side of the prevailing wind direction in summer
(e) Favorable engineering geological conditions
(f) Reduced demolition of houses to achieve minimum distances for health protection
(g) Space for future expansion
(h) Flood control standards should not be lower than the urban flood control standard
(i) Suitable drainage conditions
(j) Convenient access to transportation routes, water, and power
(k) Facilitates the collection and discharge of sewage, minimizes the depth and length of sewage pipelines, and avoids groundwater seepage areas
(l) Takes full advantage of existing facilities and drainage pipe network layout.

17. Based on the above criteria, the location selected is inside the industrial park (see Figure 1) and is favorable in terms of the requirements. The total area is 180 mu of which 46.1 mu will be used for the WWTP construction by year 2020.

1.6 Liuchuan Industrial Park Wastewater Influent Quality Analysis

18. Table 4 shows that industrial wastewater is about 90% of the total wastewater flow. Thus the wastewater influent quality is crucial to selecting an appropriate treatment process. This is done by combining estimated domestic wastewater strength with estimated industrial wastewater strength.

19. Domestic wastewater concentrations were estimated using the mid-range of concentrations specified in the PRC standard. Industrial wastewater concentrations were initially estimated using December 2013 data about industries and volume of discharge. Results are presented in section 1.6.2. LMC issued a revised list of industries at the end of March 2014. There were no changes in the type of industry (aluminum, ceramic etc.) but there are changes in discharge volumes.

1.6.1 Domestic Wastewater Concentrations

20. Domestic Wastewater Quality: The pollution load is calculated using data from "Outdoor

[1] FSR Section 5.1.1.3 (5)

Drainage Design Regulations" (GB50014-2006, 2011) and 108 L/c/d.

Wastewater Constituent		Biological Oxygen Demand	Chemical Oxygen Demand	Suspended Solids	Total Nitrogen	Ammonia Nitrogen	Total Phosphorus
	Symbol	BOD_5	COD_{Cr}	SS	TN	NH_3-N	TP
PRC GB50014-2006, 2011	g/c/d	20～50		40～65	5～11		0.7～1.4
Assume	g/c/d	25		45	6		0.8
Concentration	mg/L	230	400	410	55	25	6

g/c/d = gram per capita per day; mg/L = milligram per liter
Example: BOD_5 = 25 g/c/d / 108 L/c/d = 230 mg/L

1.6.2 Industrial Wastewater Quality, Loading, and Strength (January 2014)

21. Aluminum Industry Wastewater: Based on the "Discharge Standards for the Aluminum Industry" (GB25465-2010), the discharge limits for the newly constructed plant are:

Constituent	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)
Value	---	200	70	30	25	2.0

22. Ceramics Industry Wastewater: Based on the "Ceramic Industry Discharge Standards (draft)", major pollutants in the wastewater include pH, SS, COD, Zn, Pb, Cu, and sometimes Ni, Hg, Cd, As, and Cr are also detected. Based on "Wastewater Drainage Discharge Standards" the suggested influent quality from the ceramic plant is:

Constituent	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)
Value	80	130	400	15	12	3

23. Coal Chemical Industry Wastewater: The wastewater is typical industrial wastewater which is difficult to degrade. It mainly includes COD, BOD, Total-N, Total-Phenols, Poly-Aromatic Hydrocarbons (PAH), Sulfide, SS etc. The COD is about 500 mg/L, and NH_3-N 200~500 mg/L. Based on "Wastewater Drainage Discharge Standards" the suggested influent quality from the coal chemical plant is:

Constituent	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)
Value	60	500	100	70	45	1.5

24. Thermal Power Plant Wastewater: Cogeneration production wastewater includes recycling wastewater, chemical wastewater, other industrial wastewater and domestic sewage. Based on other similar plants, recycling wastewater accounts for about 70% of the total discharge water which has a high salt level. According to the "Wastewater Drainage Discharge Standards" the suggested influent quality from the cogeneration plant is:

Constituent	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)
Value	40	70	30	8	5	1

25. Logistics Park Wastewater: This is storage, not production, so the domestic wastewater discharge standard is used:

Constituent	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)
Value	230	400	410	55	25	6

26. Rare Earth Company: This company is currently operating but the quantity and quality of discharge is classified confidential so the values are from rare earth industry discharge standards specified in the "Rare Earth Industry Wastewater Discharge Standards" (GB26451-2011).

Constituent	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)	pH
Value	----	100	100	70	50	5	6 – 9

27. Year 2020 wastewater loading and strength was estimated by applying a weighted average approach to the estimated discharge volume and wastewater strength.

Table 6: Estimated Wastewater Influent Concentrations for Year 2020

Industry	Volume (m^3/d)		Unit	BOD_5	COD_{Cr}	SS	TN	NH_3-N	TP
Gansu Hongtai Aluminum Co. Ltd.	4,000	Strength	mg/L	---	200	70	30	25	2
		Loading	kg	0	800	280	120	100	8
Coal-Chemical Integration Project	10,000	Strength	mg/L	60	500	100	70	45	1.5
		Loading	kg	600	5,000	1,000	700	450	15
Baiyin Jiarui Ceramics Co. Ltd.	600	Strength	mg/L	80	130	400	15	12	3
		Loading	kg	48	78	240	9	7.2	1.8
Baiyin Honglu Aluminum Co. Ltd.	4,000	Strength	mg/L	---	200	70	30	25	2
		Loading	kg	0	800	280	120	100	8
Guangdong Foshan Polished Brick Plant	600	Strength	mg/L	80	130	400	15	12	3
		Loading	kg	48	78	240	9	7.2	1.8
Cogeneration Plant	3,000	Strength	mg/L	40	70	30	8	5	1
		Loading	kg	120	210	90	24	15	3
Shanghai Zhongjin Automobile Logistics	2,400	Strength	mg/L	230	400	410	55	25	6
		Loading	kg	552	960	984	132	60	14.4
Liuchuan Rare Earth Company	5,100	Strength	mg/L	----	100	100	70	50	5
		Loading	kg	0	510	510	357	255	25.5
TOTAL INDUSTRIAL LOADING	29,700		kg/d	1,368	8,436	3,624	1,471	994.4	77.5
Domestic Wastewater	4,000		kg	920	1,600	1,640	220	100	24
Total Loading	33,700	Loading	kg	2,288	10,036	5,264	1,691	1,094	102
		Strength	mg/L	68	298	156	50	32	3

Source: TA Consultants
Note that:

(a) the individual concentrations in the tables above are mostly higher values within the range;
(b) industrial wastewater (29,700 m^3/d) is about 88% of the total volume; and
(c) about 80% of the total volume has BOD_5 < 100 mg/L making the water primarily inorganic which makes ordinary biological treatment processes difficult.

1.6.3 Industrial Wastewater Quality, Loading, and Strength (March 2014)

28. Table 7 lists the design parameters that LDI used for the LIP WWTP. All influent parameters are higher than the total loading shown in Table 6. This provides a margin of safety.

Table 7: LIP WWTP Design Parameters (mg/L)

Indicator	BOD_5	COD_{Cr}	SS	TN	NH_4^+-N	TP
Influent	120	350	200	56	42	3.1

Source: FSR Table 5.1.1.3-5:

1.7 Wastewater Treatment Goals

29. The WWTP will be designed to produce Class 1A wastewater. Based on the estimated influent quality, the table below shows the necessary percent removal for the major constituents.

Table 8: Maximum Limits for WWTP Influent and Effluent

Parameter	Biological Oxygen Demand	Chemical Oxygen Demand	Suspended Solids	Total Nitrogen	Ammonia Nitrogen	Total Phosphorus	pH
Symbol	BOD_5	COD_{Cr}	SS	TN	NH_3 - N	TP	pH
Maximum Influent	120	350	200	56	42	3.1	6.5 – 8.5
Maximum Effluent	10	50	10	15	note 1	0.5	
% Removal	92%	86%	95%	73%		84%	
Note 1	temperature > 12 °C, ≤ 8 mg/L				5	88%	
	temperature ≤ 12 °C, ≤ 15 mg/L				8	81%	

The Plant Influent Quality and GB18918-2002 "Urban Sewage Treatment Plant Pollutant Discharge Standards" for Class 1A

30. Estimated strengths for TN, NH_3-N, and TP in Table 6 are slightly higher than the maximum influent shown in Table 8 So the % removal for these constituents should be higher. At this point in time there is no need for any changes due to uncertainties in the estimates of Table 6 and the capability of the WWTP to reduce nitrogen and phosphorus concentrations.

31. Wastewater sludge treatment goals are set according to CJ3025-1993 "Urban Sewage Treatment Plant Sewage Sludge Discharge Standard" requirements: (a) protection of the environment; (b) adaptation to local conditions to take a reasonable approach to the economics of the stabilization process which is to reduce (i) organic matter; (ii) sludge volume; (iii) subsequent sludge disposal costs; (iv) phosphorus; and (c) moisture content not exceeding 60% for sending to landfill[2].

32. The plan is to reuse the wastewater effluent for industrial processes and landscape irrigation. However, despite the target of 100% reuse, there needs to be a location to discharge excess treated wastewater in the event there is more volume than can be reused, or the wastewater reuse system is temporarily non-operational. A by-pass has been proposed with discharge outlet to the Dasha River and then flow into the Yellow River. Evaluated in the Initial Environmental Examination (IEE), the impact to the Dasha River from the treated wastewater discharge is acceptable, especially since this will only occur when effluent reuse is temporarily not possible (e.g. during maintenance of reuse facilities).

1.8 Wastewater Treatment Process

33. The FSR evaluated three treatment processes: (1) Anaerobic/Anoxic/Oxic (A^2O); (2) Cyclic Activated Sludge System (CASS); and (3) G-BAF Process, a proprietary, patented process using Biological Aerated Filter.

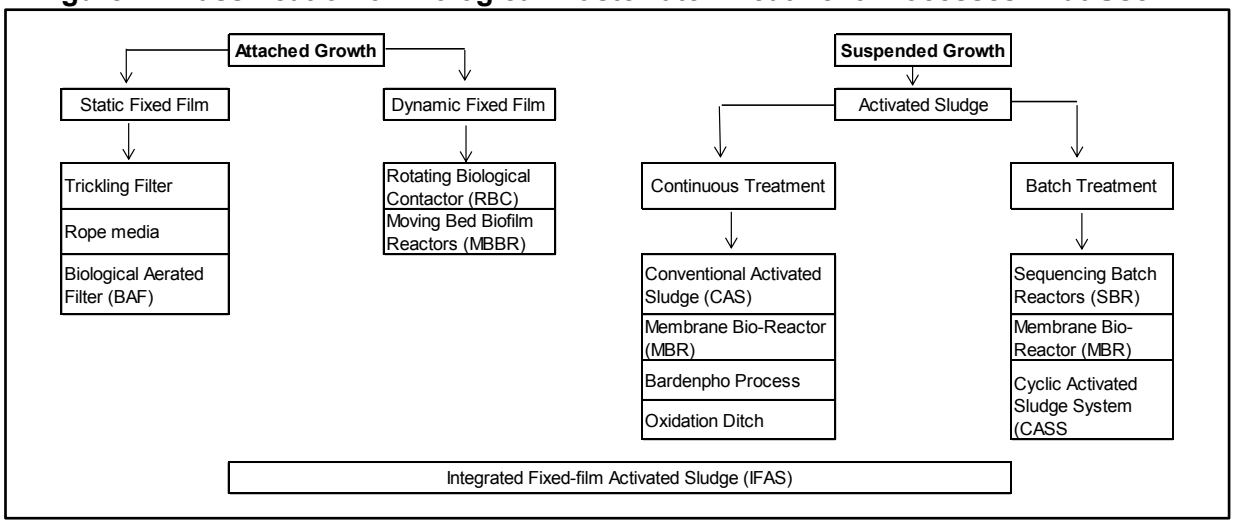
1.8.1 Overview of Wastewater Biological Treatment Processes

34. Biological wastewater treatment can be anaerobic (without air) or aerobic (with air).

[2] PRC standard “The Disposal of Sludge from Municipal WWTP” (CJ/T249-2007)

Anaerobic processes are not widely used in the People's Republic of China (PRC). Figure 2 shows how aerobic processes can be classified.

Figure 2: Classification of Biological Wastewater Treatment Processes That Use Air



35. Attached-growth: Biological treatment processes in which the microorganisms responsible for the conversion of the organic matter or other constituents in the wastewater to gases and cell tissue are attached to some inert medium, such as rocks or specifically designed ceramic or plastic materials.

36. Static Fixed Film: Fixed media. Rope media consist of strands of rope tied in a hexagonal pattern to provide surface area for the media to grow. Metal chains are also used.

37. Dynamic Fixed Film: The media moves.

38. Suspended-growth: Biological treatment processes in which the microorganisms responsible for the conversion of the organic matter or other constituents in the wastewater to gases and cell tissue are maintained in suspension within the liquid.

39. Biological filter: a bed of sand, gravel, broken stone or other medium through which wastewater flows or trickles, which depends on biological action for effectiveness.

40. Moving Bed Biofilm Reactors (MBBR): For biofilm attachment MBBR uses specially-designed plastic carrier media elements that are held in suspension throughout the reactor by turbulent energy imparted by aeration, liquid recirculation, or mechanical mixing energy. MBBR is a continuous flow-through process, eliminating the need for backwashing of the media. It is a once-through process, no Returned Activated Sludge. MBBR is useful for retro-fitting CAS systems because it increases capacity without changing the existing reactor (basin) dimensions.

41. Conventional Activated Sludge (CAS): After primary settling, the wastewater is aerated to promote growth of micro-organisms that convert the organic material to gases. The wastewater from the aerobic tank then goes through a gravity settling process in the secondary clarifier to remove solids. A portion of the solids are returned to the start of the aerobic tank to provide sufficient micro-organisms.

42. Bardenpho: A four-step activated sludge process that is effective in removing nutrients (nitrogen and phosphorus) without chemicals.

43. Membrane Bio-Reactor (MBR): process variation on the conventional activated sludge process where treated wastewater passes through a polymeric membrane (microfiltration or ultrafiltration unit) to achieve better effluent quality, particularly for re-use.

44. Integrated Fixed-film Activated Sludge (IFAS) is a hybrid process that combines fixed-film and conventional suspended-growth activated sludge treatment processes. It includes Returned Activated Sludge.

45. Sequencing Batch Reactor (SBR) is an Intermittent Activated Sludge process in which the liquid waste stream is treated in a single vessel by subjecting it to sequenced periods of filling, aeration, solids–liquid separation, and decanting of the liquid.

46. Cyclic Activated Sludge System (CASS) is a type of SBR and has plug-flow initial reaction conditions and a complete-mix reactor basin. The repeated sequence of aeration and non-aeration provides aerobic, anoxic, and anaerobic process conditions, which, in combination with the aeration intensity, are effective in removing nitrogen and phosphorus.

47. Advantages of attached growth processes compared to activated sludge process include:

- Attached growth processes provide additional surface area for biofilm to grow on
- Reduced operating and energy costs
- Attached growth processes are more effective in nitrification of wastewater than activated sludge processes.
- The overall foot-print for an attached growth treatment system is smaller than the comparable sized activated sludge process system.
- Due to lower sludge production, the sludge handling and dewatering facility is smaller compared to the activated sludge process.

48. The primary advantages of static fixed film versus dynamic fixed film are less mechanical equipment and lower operating costs. However dynamic fixed film systems can treat a larger volume for the same-sized treatment plant area.

1.8.2 Selecting the Wastewater Treatment Process

49. For biological wastewater treatment to succeed, the waste must be bio-degradable. The ratio BOD_5/COD_{Cr} determines that. From data in Table 6 the ratio is about 0.23 classifying the wastewater as not biodegradable.

BOD_5 / COD_{Cr}	**$>$ 0.45**	**0.45 ～ 0.3**	**0.3 ～ 0.25**	**$<$ 0.25**
Biodegradability	Easy	Biodegradable	Difficult	Not biodegradable

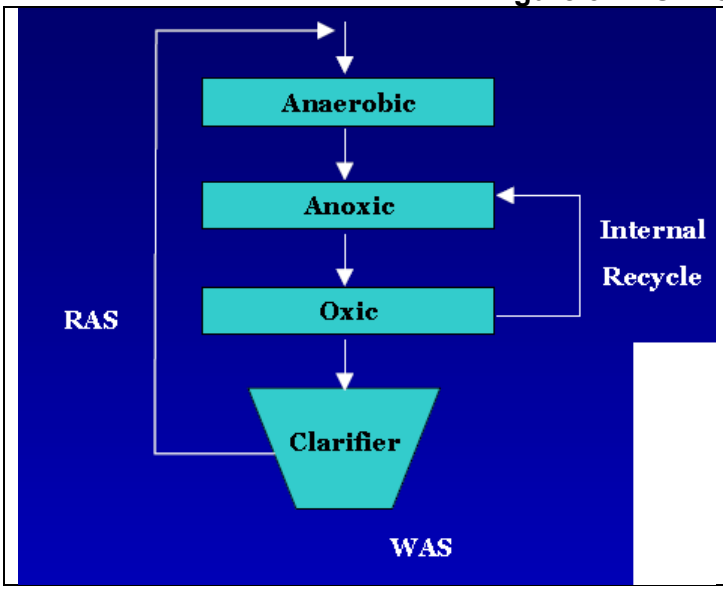
COD_{Cr} = Chemical Oxygen Demand using the dichromate reflux method
Source: FSR Table 5.1.1.4-1

50. In this situation with wastewater having a low concentration of organic matter, in the operation of the conventional activated sludge processes, carbon sources are added to enable proper operation.

51. Regarding phosphorus removal, it is likely it will precipitate out due to moderate pH (6 to 9) and high concentrations of aluminum, calcium, and magnesium in the aluminum and ceramic industrial wastewater.

52. LDI studied several different wastewater processes to select three for further evaluation: A^2O, CASS, and G-BAF.

Figure 3: A^2O Process



A^2O = anaerobic, anoxic, oxic (i.e. aerobic)

Very good removals of nitrogen and phosphorus

Requires an adequate source of organic carbon which if not already present must be added, for example methanol or acetate

Requires careful operation to balance sludge return and wasting

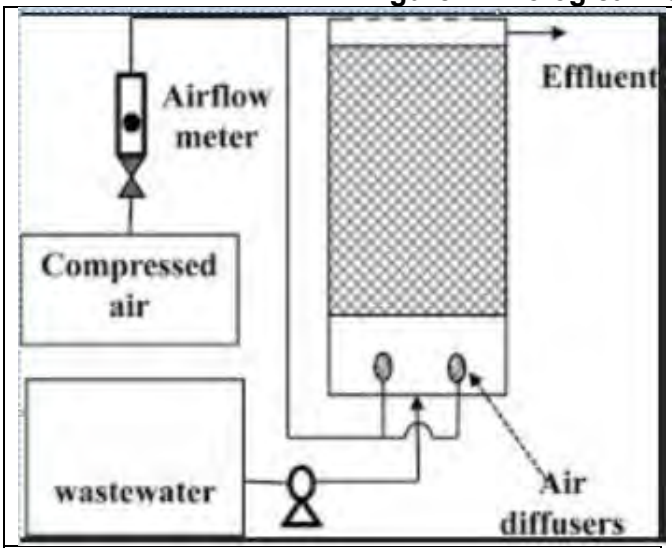
RAS = Return Activated Sludge; WAS = Waste Activated Sludge

53. CASS (Cyclic Activated Sludge System): This is a type of Sequencing Batch Reactor (SBR) operating a single biological reactor basin using repetitive cycles of aeration, settlement and discharge of the treated effluent. Baffle tanks divide each SBR tank into three zones and sludge is continuously recycled within the zones to maintain high food-to-microorganism (FM) loading conditions to remove the readily degradable soluble substrate and promote the growth of floc-forming microorganisms. As a result, the total process cycle time can be shorter than the typical SBR process cycle time when treating domestic wastewater and this enables use of smaller tanks and equipment, thus reducing land area required and costs. The CASS system operates with the following repeated time-based process cycle:

1. FILL – AERATION (for biological reactions, two hours duration)
2. FILL – SETTLEMENT (for solids-liquid separation, one hour duration)
3. DECANT (to remove treated effluent, one hour duration total).

54. For round-the-clock operations the cycle is repeated six times in a 24-hour period.

Figure 4: Biological Aerated Filter (BAF)



Up-flow Biological Aerated Filter Design

Wastewater effluent is pumped upward through inert, submerged media that provides a surface for micro-organisms to grow (static fixed film). Air is blown through the media (aeration) to create aerobic conditions.

The micro-organisms convert solids to gases and take up Nitrogen and Phosphorus. Thus the influent concentrations are reduced.

Periodically the media is backwashed by air-water (however G-BAF does not need to be backwashed).

Compared to Conventional Activated Sludge, BAF is more compact; lower in operational costs; stable in operations; produces less noise and less odor' and requires less land (footprint) area for the same volume treated.

55. LDI identified these advantages for BAF compared to A^2O and CASS:

- no need for secondary clarifiers reducing land requirements and capital costs
- no return activated sludge making operations easier
- produces less noise and less odor
- more stable at low temperatures.

56. Based on the comparison the LDI selected the G-BAF process, a type of BAF unique to the PRC, described in the following sections.

1.8.3 Biological Aerated Filter (BAF)[3]

57. In the BAF process wastewater flows through tanks (called cells) that are filled with media while air is added to the bottom of the cell to provide oxygen for the microorganisms See Figure 5. During operation, the filter cells are periodically washed (i.e. backwashing) to remove excess biological growth and flush out captured suspended solids. This is accomplished by increasing the flow rate through the filter, and agitating the filter media using an air scour system to loosen the media bed. The waste stream from backwashing is returned to the treatment plant for subsequent treatment.

58. The media within the filter cells is tightly packed and provides a surface for microorganisms to attach to and grow on. Typical media depth is 2 to 4 meters. The flow of wastewater through the tightly packed media provides filtering, eliminating the need for a separate clarification step in the treatment process.

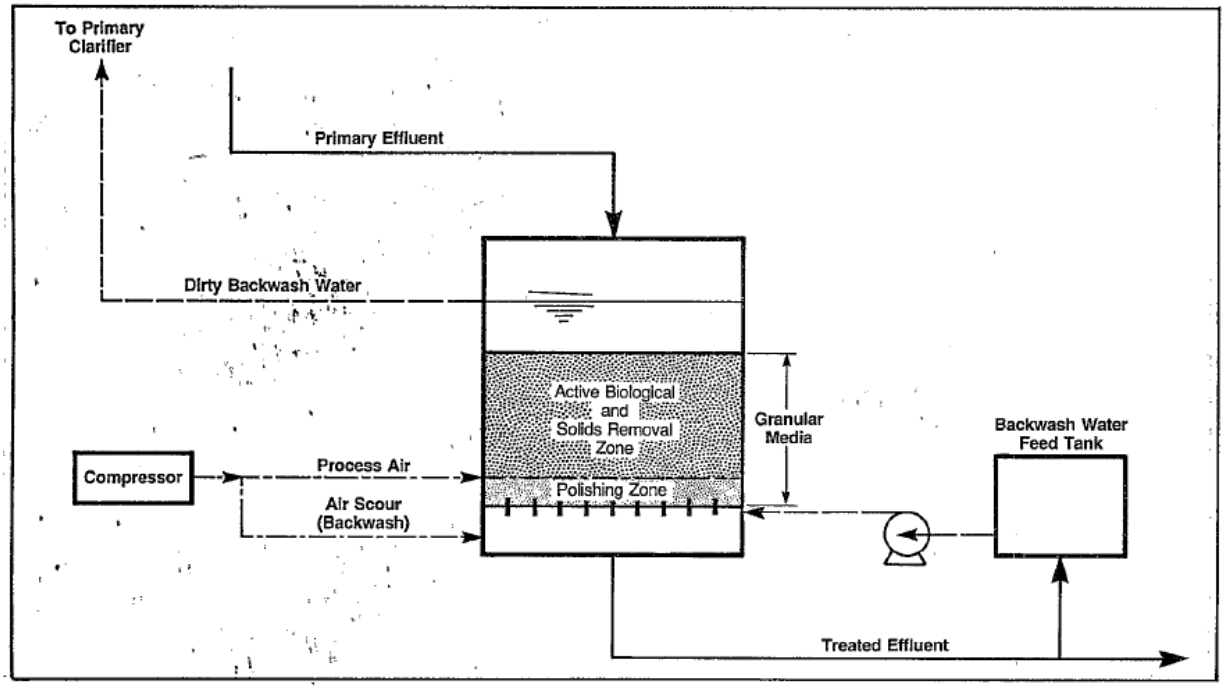
59. Two advantages of the BAF system compared to activated sludge systems are (a) no need for secondary clarifiers which reduces land requirements and capital costs; and (b) no return activated sludge which makes operations easier.

60. It is essential properly functioning Primary Sedimentation Tanks precede the BAF to reduce the solids loading and prevent clogging.

61. The BAF system typically employs multiple filter cells that are rotated in and out of service as needed to accommodate varying wastewater flow rates and concentrations of organic materials in the flow.

[3] Leopoldo Mendoza-Espinosa and Tom Stephens (1999). A Review of Biological Aerated Filters for Wastewater Treatment. Environmental Engineering Science, volume 16, number 3. Email t.stephenson@cranfield.ac.uk

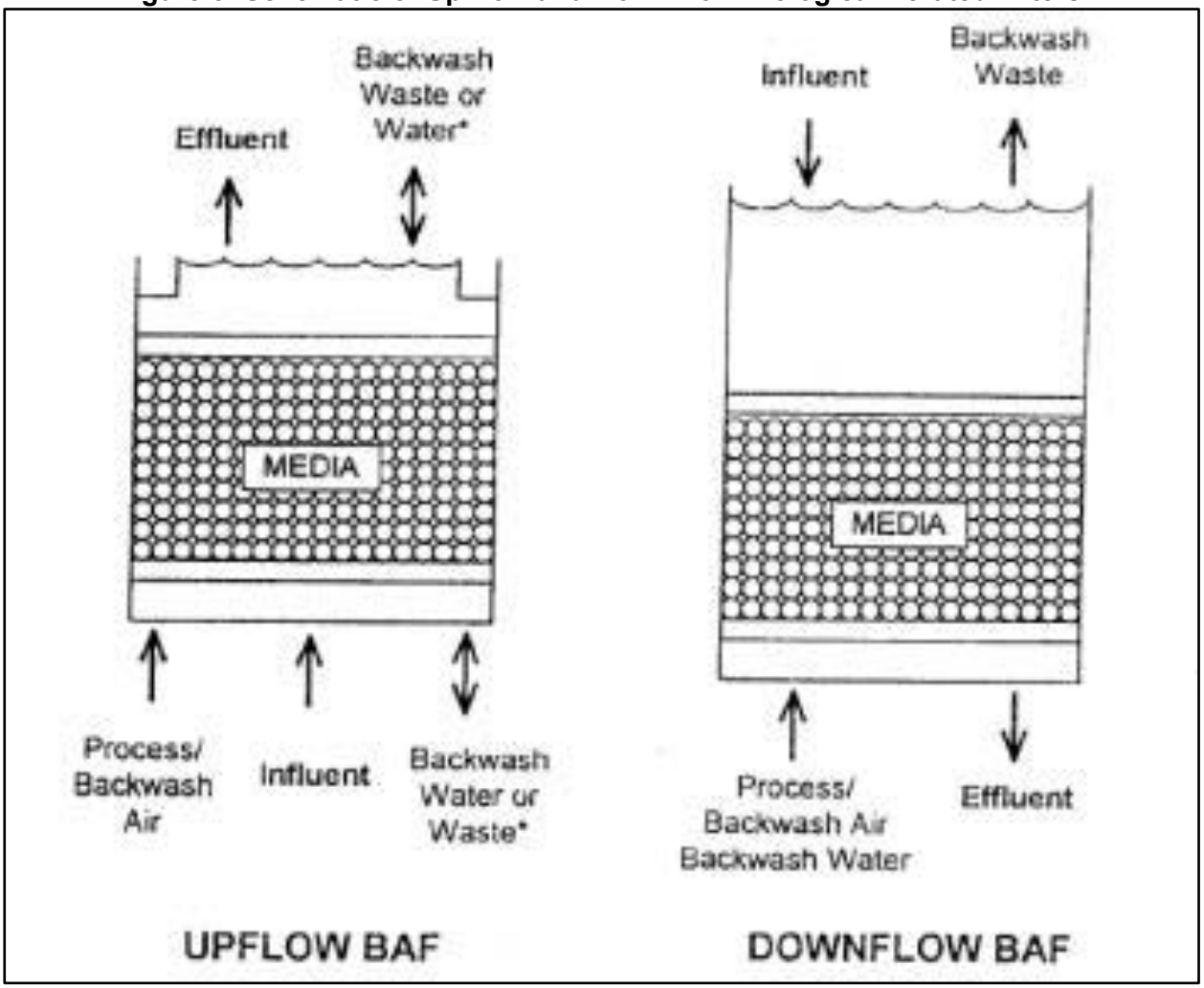
Figure 5: Biological Aerated Filter



Source: USEPA (July 1983). An Emerging Technology: The Biological Aerated Filter

62. Flow can be upward or downward (see Figure 6). Down-flow BAF with counter-current air/water creates more contact time between effluent and air and has fewer blockages of influent nozzles.

Figure 6: Schematic of Up-flow and Down-flow Biological Aerated Filters



Source: USEPA (July 1983). An Emerging Technology: The Biological Aerated Filter

63. The media within the filter cells is tightly packed and provides a surface for microorganisms to attach to and grow on. Typical media depth is 2 to 4 meters. BAF media should be resistant to attrition, chemically stable, have a high specific surface area, and low weight. Granular media can be either denser than water to create sunken media or less dense than water to produce floating media. Denser media require higher backwash flow rates, thus higher energy costs.

64. The flow of wastewater through the tightly packed media also provides filtering, eliminating the need for a separate clarification step in the treatment process. The use of large media (> 6 mm) reduces the area available for biofilm growth but is easier to backwash compared to smaller media (< 3 mm). Measurements show that irregular shaped media improves performance and that rough surface media provides more sites for biofilm attachment than smooth media.

65. Backwashing is necessary to remove captured solids and excess biomass. It is done by air-scour and high-rate liquid flow. The backwash cycle must not damage the media nor wash away excess biomass, which is required to restart the treatment process. The backwash water is recirculated through the system.

66. BAF is more stable at low temperatures than suspended growth processes and dynamic fixed film processes.

67. Applications in the PRC: locations[4],[5] in the PRC with BAF / G-BAF are:

(A). Shandong Tiexiong coking wastewater treatment works
(B). Xinjiang Bayi Iron & Steel coking wastewater treatment works
(C). Karamay oil refinery wastewater treatment works
(D). Wenzhou leather wastewater treatment works
(E). Tianjin Petrochemical Company refinery wastewater treatment works
(F). Beijing Wenyu water decontamination
(G). Beijing Zhongnanhai water decontamination
(H). Beijing river water decontamination
(I). Henan Yanshi wastewater treatment plant upgrade project
(J). Dongguan East Lake water purification works.

1.8.4 G-BAF

68. G-BAF technology has the advantages of traditional BAF and improves on the disadvantages such as large head loss and frequent backwashing. The G-BAF technology uses functional macro-porous mesh suspended media which combined with efficient fixed microorganisms creates an anaerobic – anoxic – aerobic integrated micro-environment, facilitating the formation of nitrogen flora microenvironment. In G-BAF, the macro-porous media accounts for 50-60% of the aeration tank, with effective fixing of microorganisms on it.

69. G-BAF uses a proprietary product called BCP, which according to the supplier: “is a series of efficient microorganisms, which has a high degradation of ammonia and organic chemicals commonly found in industrial wastewater including refractory complex organic compounds, aliphatic hydrocarbons, aromatic compounds, phenolic compounds, fatty acids, tannery waste, pharmaceutical waste, ketones, and surfactants. With the use of nitrating agent, the BCP can help nitration reactions used in the treatment of high concentrations of ammonia wastewater. A tolerance of high organic load, fast cells growth, and high utilization rate characterize BCP; all these features help to stabilize the plant operation and applied to many other occasions.”

70. BCP active ingredients are microorganisms and enzymes. The chemical composition is: proteins, starches, fats, polysaccharides and trace elements. The BCP micro-organisms can grow under either aerobic or anaerobic conditions and can function over a temperature range of 5 to 45 ℃. This is useful in Baiyin where winters are cold and summers hot.

71. Compared with conventional bio-treatment technologies, G-BAF is reported to have the following characteristics:

1) Biodegradation process is fast and the effluent quality is high. The technology uses advanced bio-active molecule immobilization technology, fixing the efficient microorganisms on the special macro-porous mesh media, increasing the loading capacity by 10 to 20 times compared to conventional biological treatment processes.
2) This technology has high microbial activity, fast breeding cycle, wide adaptability, and strong degradation resistance. The G-BAF uses BCP[6] series of highly efficient complex microbial agents, compared with conventional process, the rate of microbial degradation of organic matter increased 100 times.
   - BCP active ingredients are microorganisms and enzymes. The chemical composition is: proteins, starches, fats, polysaccharides and trace elements.
   - The BCP micro-organisms can grow under either aerobic or anaerobic conditions

[4] FSR (31 December 2013) 5.1.1.4 (2) (2)
[5] It is reported, but not confirmed, that Shanghai Xinjiang WWTP located in Shanghai’s Jinshan District uses the TETRA ColOX BAF system from Severn Trent Services http://www.wwdmag.com/channel/casestudies/addressing-china%E2%80%99s-wastewater-discharge-standards
6 BCP is the name of a specific mixture of micro-organisms.

and can function over a temperature range of 5 to 45 ℃.

3) Small land area, low investment, and operation cost. The volume of the aeration tank for this technology is 20 to 50% of a common activated sludge aeration tank. Sludge volume is 3 to 5 % of traditional biological processes. Therefore the secondary clarifier (sedimentation) tank can be eliminated. Since the microorganisms are fixed, this prevents the loss of microorganisms. Investment in infrastructure can be reduced by 30% and operational costs by 30 to 50%.
4) This technology has unique effect for refractory organics[7] and ammonia. The ammonia removal efficiency is more than 99% and is 85% for total nitrogen removal; By controlling the G-BAF reactor operating parameters in different levels, the resulting aerobic and anaerobic macro-environment, ensures the removal of phosphorus by excessive intake of phosphorus and phosphorus release.
5) High shock-resistance capability. The biomass on the surface of the media can grow up to 40 g/L, 10 to 20 times than that of conventional activated sludge process. The high load of G-BAF reactor guarantees the stable and efficient removal of contaminants.
6) Low sludge generation and no sludge bulking help ensure the effluent quality. As a result of fixed micro-organisms media, the presence of anaerobic and aerobic environment result in microbial stratification and clustering phenomenon, with long microbial chains, and lower amount of sludge produced.
7) The technology does not produce odor during operation.
8) Technical operation and management is easy and convenient. Since it has no sludge return system; equipment can be operated and stopped easily. Even if the equipment is stopped for a year, the system recovering to normal only needs aeration for one week; no special management is needed.

1.8.5 BAF/G-BAF Operational Data

72. Table 9 lists facilities LDI identified in the PRC using BAF or G-BAF technology and the influent and effluent concentrations for Chemical Oxygen Demand (COD) and Ammonia Nitrogen (NH_3-N). The pollutant reduction for COD is significant but exceeds PRC Class 1A by 20%. Class 1A discharge may not be a requirement for these WWTP or there may be a follow-on treatment step.

Table 9: BAF / GBAF Data from Feasibility Study Report

		Influent (mg/L)		Effluent (mg/L)		Capacity
	Wastewater Treatment Plant	**COD_{Cr}**	**NH_3-N**	**COD_{Cr}**	**NH_3-N**	**m^3/d**
A	Shandong Tiexiong coking	150	50	60	15	3 x 7,200
B	Xinjiang Bayi Iron & Steel coking	150	15	60	15	10,800
C	Karamay oil refinery	100	15	60	5	7,200
D	Wenzhou leather	300	200	100	15	10,000
E	Tianjin Petrochemical Company refinery	100	15	60	5	7,200
F	Beijing Wenyu water decontamination	80 – 400	20 – 45	Meet Class A Discharge Standard		17,000
J	Dongguan East Lake (domestic wastewater)	120 – 180	20 – 30	20	1	Lake Area 50,000 m^2

Source: Gansu Baiyin FSR, Section 5.1
(G, H, & I not included here)
Influent NH_3-N for WWTP #B needs to be checked
COD_{Cr} = Chemical Oxygen Demand by Chromium Reflux Method; NH_3-N = Ammonia Nitrogen

73. Table 10 and Table 11 show operational data for WWTP using G-BAF.

7 Refractory organics are chemicals that are relatively non-biodegradable, such as chlorinated alkanes, poly-aromatic hydrocarbons, pesticides, solvents, benzenes, phenols etc. They tend to pass through conventional domestic wastewater treatment processes.

Table 10: Sample of WWTP in the PRC Using G BAF

No.	Wastewater Treatment Plant (WWTP)	Location	Year Built	Design Capacity (m^3/day)	% Industrial Wastewater	G-BAF		
						Up-flow or Down-flow	Backwash	Chemical Addition
1	Liaoning Qingyang Special Chemical Industry Co. Ltd.	Liaoyang City, Liaoning Province	2007	6,000	100%	Both	No	No
2	Beijing Erdao River	Chaoyang District, Beijing	2004	30,000	50%	Both	No	No
3	Luan Huanneng Coal and Chemical Industry Co. Ltd.	Changzhi City, Shanxi Province	2006	5,000	90%	Both	No	Soda
4	Xinjiang Bayi Steel and Iron Co. Ltd.	Urumqi, Xinjiang AR	2009	11,000	82%	Both	No	NR
5	Malanhe	Dalian, Liaoning Province	2001	120,000	0%	Up-flow	Yes	NR

Source: Professor YE Zhengfang
NR = Not Reported

Table 11: Operational Data of Table 10 WWTP in the PRC Using G-BAF

WWTP No.	1			1			2			2		
Date	20-Jun-07			14-Dec-13			15-Jun-12			24-Dec-13		
Temperature (°C)	26			18			20			8		
Volume (m^3/d)	6,000			6,500			30,000			40,000		
	mg/L		%	mg/L		%	mg/L		%	mg/L		%
Parameter	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**
BOD_5	-	-	-	-	-	-	183	5	97%	-	-	-
COD	370	46.3	87%	1,600	48.2	97%	369	26	93%	202	46.8	77%
SS	-	10	-	-	9	-	-	-	-	86	10	88%
Total Nitrogen							41.2	12.8	69%	28.6	13.6	52%
Ammonia Nitrogen	-	0.5	-	-	-	-	35	0.5	99%	23.4	2.7	88%
Total Phosphorus	-	-	-	-	-	-	3.9	0.3	92%	2.7	0.32	88%
WWTP No.	3			3			4			4		
Date	26-Jun-12			31-Jan-13			25-Jul-11			18-Dec-12		
Temperature (°C)	30			24			30			24		
Volume (m^3/d)	5,000			5,000			11,000			11,000		
	mg/L		%	mg/L		%	mg/L		%	mg/L		%
Parameter	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**
BOD_5	-	-	-	-	-	-	183	5	97%	-	-	-
COD	1,294	82	94%	1,650	123	93%	369	26	93%	282	42	85%
SS	169	12	93%	87	9	90%	-	-	-	87	11	87%
Total Nitrogen	-	-	-	-	-	-	41.2	12.8	69%	-	-	-
Ammonia Nitrogen	425	5	99%	232	6.2	97%	35	0.5	99%	23.2	0.5	98%
Total Phosphorus	-	-	-	-	-	-	3.9	0.3	92%	-	-	-
Oil	5.76	0.32	94%	3.68	0.22	94%	1	0.05	95%	0.8	0	100%
WWTP No.	5			5								
Date	20-Jun-03			16-Nov-13								
Temperature (°C)	19			7								
Volume (m^3/d)	150,000			110,000								
	mg/L		%	mg/L		%						
Parameter	**Influent**	**Effluent**	**Removal**	**Influent**	**Effluent**	**Removal**						
BOD_5	280.8	5.4	98%	-	1.9	-						
COD	122.4	30	75%	228	20	91%						
SS	191	8	96%	-	2.5	-						
Total Nitrogen	-	-	-	33.4	17	49%						
Ammonia Nitrogen	26.3	0.53	98%	25.3	0.154	99%						
Total Phosphorus	-	-	-	2.84	0.52	82%						

Source: Data provided by Professor YE Zhengfang, February 2014
WWTP No. is from Table 10
Note: Temperature is of the wastewater influent
BOD_5 = 5-Day Biological Oxygen Demand; COD = Chemical Oxygen Demand; SS = Suspended Solids; mg/L = milligrams per Liter

74. In Table 11 temperature is of the wastewater influent. WWTP # 3 Lu'an Huanneng Coal and Chemical Industry Co., Ltd., and WWTP #4 Xinjiang Bayi Iron and Steel Co. Ltd. mainly produce coking wastewater which includes ammonia evaporation wastewater that has a temperature between 80 and 90 degrees Celsius (^{o}C), which, when mixed with other waste water, results in a summer-time temperature, about 40 ^{o}C. This needs to be cooled to about 30 ^{o}C. In winter cooling is not needed and the temperature is around 25 ^{o}C. For WWTP #1, located in Liaoning Province, heating is applied in the winter to maintain the water temperature above 15 ^{o}C, which is a winter-time design parameter to assure proper functioning of biological processes[8].

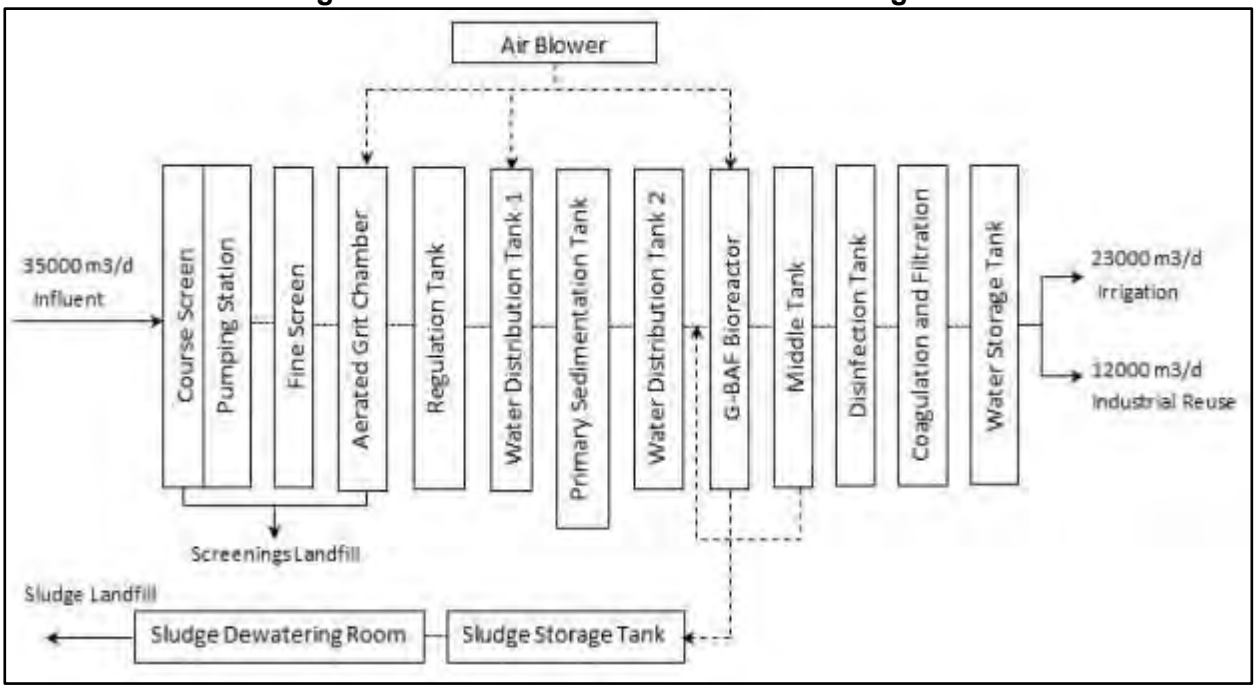
75. Four of the five WWTP in Table 11 are 50% to 100% industrial wastewater making them similar to the LIP WWTP whose influent will be about 90% industrial wastewater. The percent removals shown in Table 11 show that the G-BAF system can work.

76. Effluent COD for WWTP #3 (Coal and Chemical Industry) in Table 11 exceeds the PRC 1A standard but so too does the influent concentration exceed PRC Standard CJ343 – 2010 (See Annex 2 for the parameters and values). This illustrates the importance of an industrial pre-treatment program at the LIP.

1.8.6 Specific Elements of the G-BAF System for LIP

77. Figure 7 is a schematic of the WWTP process.

Figure 7: LIP Wastewater Process Flow Diagram



Source: FSR Figure 5.11
Note: The FSR shows 23,000 m^3/d for irrigation but estimates are it will be less than 6,000 m^3/d. That increases the volume of reclaimed wastewater available for industrial reuse.

78. The G-BAF will be in four series, the first and third with flow upward, and the second and the fourth with down-flow. The media is modified polyurethane material in random sized lumps with side length of 30 ~ 50 mm. There is no backwashing but the Middle Tank that follows the G-BAF bioreactor can re-circulate into the bioreactor when there are high concentrations of suspended solids.

[8] Dr. Dongfang Liu, Professor Nankai University College of Environmental Science and Engineering, Tianjin, PRC (email 1 August 2014)

79. To deal with the risk of low (acidic) pH the G-BAF tank systems will be equipped with an alkali dosing system of 10% sodium carbonate solution into the Regulation Tank that can adjust the pH to 7 – 8.5. This will not affect the cost estimate.

80. Micro-organisms need a source of carbon for growth. They prefer organic carbon to inorganic carbon, oxidize it to carbon dioxide (CO_2) and water (H_2O) and use these compounds and the energy for biomass synthesis. There is a risk of insufficient organic carbon where the wastewater is primarily industrial. So it is common for activated sludge processes treating industrial wastewater to include a system to add a source of organic carbon.

81. That does not seem to be a problem for G-BAF as evidenced by the data in Table 9 and Table 11. The specialized BCP microorganisms used in the G-BAF can effectively degrade the refractory organics in wastewater, which are not accessible to the micro-organisms of the activated sludge process. Furthermore, the de-nitrification process provides energy and substrate for the BCP.

82. Nevertheless, the LDI has designed a carbon dosing system using glucose as the carbon source. Glucose is readily available, easy to store, and has less safety concerns than other carbon sources such as methanol. The external carbon source will be added in the front of the anaerobic biological filter used for the de-nitrification process. The dosage will range from 0 to 50 g/m^3 as needed.

1.8.7 G-BAF Suppliers or Contractors

83. Following is a list[9] of suppliers or contractors in the PRC who have experience installing or constructing G-BAF.

- Beijing Fengzelvyuan Environment Technology Co. Ltd.
- Gansu Beidazhengfang Environment Science and Technology Co. Ltd.
- China Wuzhou Engineering Group
- Beijing Fengrun Environment Science and Technology Co. Ltd.
- Beijing Huaxiaqingyuan Environment Science and Technology Co. Ltd.

Interview details

Company	Location	Contact Person & Telephone	Title
China Wuzhou Engineering Group	Beijing	ZHANG Mohe 86-10-83196214	Project Chief Engineer
Beijing Fengzelvyuan Environment Technology Co. Ltd.	Beijing	LI Zengxiong 86-10-62982031	General Manager
Beijing Fengrunlvyuan Environment and Science Co. Ltd.	Beijing	CHEN Jian 86-10-58745905	Engineer
Gansu Beidazhengfang Environment Science and Technology Co. Ltd.	Baiyin, Gansu	WANG Zhongyou 86-943-8290058	General Manager
Beijing Huaxiaqingyuan Environment Science and Technology Co. Ltd.	Beijing	ZHAO Quanlin 86-10-62667720	Chief Engineer

84. These five companies were interviewed (13 – 17 April 2014) to learn about their experience and get their comments about G-BAF.

- All five have participated in several G-BAF WWTP projects in the PRC.
- Most of the suppliers will provide the media, the bacteria, and related equipment, as well as management and operation services;
- The pre-operating and testing period usually takes 1 week and might be longer

[9] Provided by Professor YE Zhengfang

depending on the influent composition;

- This system can adapt to high COD influent (up to 2,000 to 3,000 mg/L);
- The major problem during operations is the fluctuation of the influent concentration which may cause sudden impact to the bacteria; but generally the operation will go back to normal after buffering for several days;
- The sludge production is extremely low, usually they remove the sludge every three to six months (this is due to the long bacteria chain in the media);
- The management and operation is relatively easy, according to the interviews, the number of staff needed for a large plant (above 10,000 t/d) is usually 4-5.

85. Table 12 is a cost comparison of the three wastewater options that LDI evaluated. Regarding the investment, operation cost, and other financial factors, G-BAF also has advantages compared to the other two options.

Table 12: Cost Comparison for the Three Wastewater Options for 35,000 m^3/d

		A/A/O process	CASS process	G-BAF process
Investment	Total investment (CNY10,000)	22825.82	22793.42	21843.36
	Construction cost (CNY10,000)	18730.24	18483.82	17169.57
Staffing	Staffing Requirements	45	45	30
WWTP Power consumption	Installed capacity (kW)	1,000	1,123	621
	Annual power consumption (10,000 kWh)	561	602	437
Operating costs	Total annual cost (CNY10,000)	2263	2336	2180.21
	Total unit cost (CNY/m^3 of sewage)	1.77	1.83	1.71
Treatment effect	Organics removal efficiency	High	High	High
	Nitrogen and phosphorus removal efficiency	High	High	High
Sludge	Sludge production (T.ds/d)	9.0	9.0	7.6
Head loss	Secondary treatment total head loss (m)	1.5	4.2	1.5
Process	Degree of Difficulty	Relatively simple	Relatively simple	Simple
Controls	Automation control requirements	Relatively simple	Relatively high	High
Management	Ease of operation and management	Relatively convenient	Relatively convenient	Convenient

Source: Table 5.1.1.4-11
CNY = Chinese Yuan; kW = kilowatt; kWh = kilowatt hour; m^3 = cubic meter; T.ds/d = tons dry solids per day

1.8.8 Wastewater Disinfection

86. Comparisons of disinfection methods are shown in

87. Table 13. Chlorine Dioxide was selected.

Table 13: Comparison of Wastewater Disinfection Techniques

Method	Chlorine	Chlorine Dioxide	Ozone (O_3)	Peracetic acid	UV Irradiation	Heat treatment
Application	Water and wastewater	Water and wastewater	Drinking water and swimming pool water	Food industry, cooling tower water	Tap water and some WWTP in the PRC	Hospitals, slaughterhouses
Advantage	Mature technology, stable treatment effect, equipment has low investment and operating costs	Stable treatment effect; less investment in equipment, a small impact on the environment than chlorine	Small area, efficient sterilization, and deodorizing effect	Small footprint, sterilization, high efficiency, and deodorizing effect and control of sludge bulking	Small footprint, sterilization, high efficiency, small risk, no secondary pollution	Thorough disinfection
Disadvantage	Area large, potentially dangerous and secondary pollution	Small footprint, slightly higher operating costs than chlorine, there is secondary pollution	Need scrubber to clean excess O_3; high investment and operating costs	High running costs	High cost of equipment, running costs high, lamp life is short, water quality impact	High energy consumption and complex operation
Infrastructure Investment	Low	Low	High	Low	Relatively high	High
Operating costs	Low	Low	High	High	Relatively high	High

Source: FSR Table 5.1.1.4-5 and TA Consultants
Peracetic Acid $C_2H_4O_3$ dissolves in water to form hydrogen peroxide and acetic acid; UV = ultra-violet

1.9 Wastewater Sludge Processing

88. According to LDI, the WWTP estimated sludge production is 600 m^3/d (water content 99.4%).

89. The LDI evaluated three mechanical methods for dewatering sewage sludge and their analysis is shown in Table 14. The LDI recommends Plate and Frame Filter Press. The three mechanical dewatering methods have their own characteristics, although the plate and frame filter press requires relatively large investment and land area, considering the process target (water content of less than 60% to comply with PRC GB 16889-2008 requirements for landfill disposal) and the convenience for maintenance and management during operations, the plate and frame filter press is selected.

Table 14: Comparison of Wastewater Sludge Dewatering Techniques

Number	Parameter	Plate and Frame Filter Press	Belt filter press	Centrifuge
1	Cake moisture content %	60 ~ 70	70 ~ 80	70 ~ 75
	Concentration of incoming sludge (g/L)	2.5 ~ 3.0	3.0	3.0
2	Power consumption (kW.h/T.ds)	14 ~ 40	<10	30 ~ 60
3	Polymer dosage (kg/T.ds)	3 ~ 5	3 ~ 5	3 ~ 5
4	Operations	Intermittent	Continuous	Continuous
5	Operating Location	Semi-open	Open	Airtight
6	Operating conditions	De-sliming need some auxiliary imported equipment	Automatic De-sliming	Automatic De-sliming
7	Noise and Operator Health	Less noise, poor health conditions	Less noise, general health conditions	Noisy, good sanitary conditions
8	Fault condition	Fewer wearing parts, filter cloth periodically replaced	Moderate wearing parts, filter cloth easy to replace	Less ancillary equipment, maintenance more convenient, fewer faults
9	Equipment costs	Highest (~ CNY4 million)	Lowest (~ CNY2 million)	Relatively high (~ CNY2.8 million)
10	Construction costs	Large area, high cost, need ancillary structures	Lower; less ancillary structures	Major equipment, ancillary equipment, a host of small dimensions, the minimum civil works cost
11	Sludge Transport vehicles	Few	Many	Relatively many

Source: FSR Table 5.1.1.4-2 Comparison of Dewatering Equipment
kWh = kilowatt hour; T ds = tons dry solids

90. The LDI evaluated sludge disposal options as shown in Table 15 and recommended disposal at sanitary landfill.

91. There are two factors to consider with landfill disposal: (a) PRC Standard GB16889-2008 specifies 60% or less water content of sludge disposed in landfills and this is barely within the range of conventional mechanical dewatering equipment; (b) with an industrial pre-treatment program that is monitored and enforced there should be no heavy metals or other toxic chemicals and thus the sludge could be applied to land.

Table 15: Disposal of Wastewater Treatment Plant Sludge

Sludge Disposal Method	Processing Requirements	Remarks
Incineration	Dewatered sludge containing solids 20 ~ 30%; and needs auxiliary fuel and ancillary facilities. Sludge moisture content of 50% can generally burn without auxiliary fuel. Needs pre- and post-incineration equipment which adds to overall cost	70% to 90% volume reduction; large investment cost
Sanitary landfill	Dewatered sludge containing solids 20 ~ 40% must be stabilized and made as harmless as possible. Need a secure landfill with leachate collection and treatment	Least expensive
Composting with municipal solid waste	Mechanically dewatered sludge containing solids 20 ~ 40%; thermophilic composting to reach high temperatures to inactivate pathogens and parasite eggs	Needs people and land to use the compost
Thermal Drying	Final product can be < 10% moisture content, however requires large amount of equipment and operating costs to achieve drying	

Source: FSR Table 5.1.1.4-4 and TA Consultants

92. Incineration technology processes sludge quickly, achieves large volume reduction (70-90%), provides a high degree of sanitary treatment, and uses small land area, but the investment cost is very high, operation and management is complex, and it has high energy consumption and operating costs. It also needs a relatively large volume of waste, either municipal solid waste or wastewater sludge, to ensure a feasible and profitable operation.

93. Thermal drying is not recommended because of larger investment on equipment, much of which has to be imported. This technology is more suitable for sludge disposal projects in large-scale and economically developed areas.

94. Currently the proposed solution is that the sludge from the WWTP be disposed in a sanitary landfill as recommended in the FSR. The LIP has received an agreement from the operator of new Jingyuan County Landfill No. 2 under construction that allows the WWTP sludge to be disposed in the new landfill. However, if the industrial pre-treatment system and monitoring system operate properly, which can guarantee the quality of the sludge, potential reuse of the sludge is possible in the future.

1.10 Disposal of Wastewater Sludge at a Sanitary Landfill

95. The LDI used year 2001 data from Guangzhou sewage treatment plant sludge composition and from a study by South China Agricultural University of Shenzhen Luofang municipal sewage sludge composition and concluded it is likely the sludge in the LIP will not be suitable because with 90% of the wastewater being industrial there are likely to be chemicals such as heavy metals present in the sludge that make it unsuitable for land application as compost or soil amendment for land reclamation.

96. However the LIP will require industries to pre-treat their wastewater prior to discharge into the sanitary sewer. The Baiyin Environmental Protection Bureau (EPB) will monitor industries by in-line monitors at the point of discharge and by periodic sampling and laboratory analysis.

97. Therefore the wastewater bio-solids (a word preferable to “sludge”) can be available for land application. Analysis of pH, Nitrogen, Phosphorus, and Salinity is needed to determine its suitability as a fertilizer.

98. Sludge landfill is one effective way to treat municipal WWTP sludge even if it results in higher COD_{Cr} and BOD_5 concentrations in the leachate, which requires proper treatment anyway. Based on the widely used experience and the local situation in the PRC, the LDI recommends sanitary landfill disposal.

1.11 Wastewater Odor Control

99. Ammonia, methyl mercaptan, hydrogen sulfide, dimethyl sulfide, trimethylamine, and other compounds cause nuisance odors at WWTP. The odors are noticeable, can be uncomfortable for workers, and make it unsuitable to live in the nearby area.

100. The LDI examined the methods for odor control including (a) water cleaning and chemical cleaning; (b) activated carbon adsorption; (c) ozone oxidation; (d) soil deodorization; (e) microbiological deodorization method; and (f) combustion. The LDI selected the microbial deodorization processes as the most cost-effective. If additional deodorization is needed, then an activated carbon absorption tower can be added.

1.12 Wastewater Collection System

Figure 8: LIP Wastewater Collection System

Source: LDI and PMO

Color	Meaning
Dashed Purple Squares	Wastewater collection pipelines to be funded by ADB Loan, 46.035 km
Green	Pipelines funded domestically: Jingsan Road, 1.4 km trunk sewer and 0.25 km branch pipe, construction scheduled in March to November 2014
Light Blue	Pipelines funded domestically: Binhe Road, 3.18 km trunk sewer, construction scheduled in April to November 2016
Yellow	Pipelines funded domestically: Jingwu Road, 1.89 km truck sewer and 0.34 km branch pipe, construction scheduled in March to November 2017
Light Gray	Road network; wastewater pipelines installed as needed

101. Sewer Pipe Material. Criteria for selecting sewer pipe include strength, smooth interior wall; minimal tuberculation; corrosion resistance; weight (for transport and handling); ease of installation, and cost. The LDI evaluated socket-type reinforced concrete pipe, fiberglass sand tube, sulfate resisting cement reinforced concrete pipe, PVC-U reinforced pipe and metal drainage pipes. Results are summarized in Table 16.

Table 16: Evaluation of Sewer Pipe Materials

Pipe Material	Reinforced Concrete Pipe	HDPE double wall corrugated	RPMP	Comparison results
Diameters Available	d200 – d3,000	DN100 – DN1,000	DN100 – DN4,000	Can meet the requirements
Joint Type	Flexible or rigid rubber ring joints	Rubber ring flexible joint	Rubber ring flexible joint	All are similar.
Corrosion Resistance	Some groundwater can be corrosive.	Resistant	Resistant	HDPE double wall corrugated pipe is better.
Useful Life	40 years	50 years	50 years	HDPE better
Wall roughness coefficient	0.014	0.01	0.0109	HDPE better
Construction and installation	Heavy weight, relatively difficult to transport and install	Light weight, convenient to transport and install	Light weight, easy to transport, newer and more rigorous requirements for installation	HDPE double wall corrugated pipe is better.
Total cost (CNY/m)	d300, 202.11	DN300, 311.19	DN300, 315.63	RPMP higher
	d400, 298.66	DN400, 381.99	DN400, 398.32	
	d500, 394.38	DN500, 538.36	DN500, 549.51	
	d600, 588.69	DN600, 719.66	DN600, 729.03	
Advantages	Low cost, widely used, considerable experience	(1) Easy installation, short construction period; (2) corrosion resistance; (3) smooth pipe wall (4) becoming more widely used	(1) Easy installation, short construction period; (2) corrosion resistance; (3) smooth pipe wall	
Disadvantages	Construction and installation is relatively difficult.	(1) Cost is higher than RCP and (2) diameter specification subject to certain restrictions.	High Price	

Source: FSR
HDPE = High Density Polyethylene; RCP = Reinforced Concrete Pipe; RPMP = glass-fiber-reinforced polymer mortar pipe

102. The LDI recommends reinforced concrete sewer pipe even though HDPE pipes have advantages of convenient transportation and installation. The reason for selecting reinforced concrete pipe is the low cost and wide applicability, and contractors' familiarity with its installation.

103. Sewer Pipe Size: According to the year 2030 LIP layout, pipe diameter minimum is 400 mm and maximum 1,200 mm.

104. Sewer Pipe Design. Gravity flow with minimum rate of 0.6 meter per second (m/s) and maximum design flow rate of 5 m/s. Slopes are of the order of 0.2%. Minimum depth is 2.50 m, which seems excessive considering that the ground maximum frozen depth is 1.10 m. The reason may be connection with existing sewer network.

105. Sewer Manholes. Locations are at pipeline intersections, bends, or change in grade or diameter. Spacing is in accordance with GB50014-2006 "Outdoor Drainage Design Specifications" (2011 edition) ranging from 40 m to 100 m. The primary criterion for manhole spacing is the reach capacity of sewer cleaning equipment; with modern equipment distances > 100 m are possible, which would reduce construction costs. However the LDI is obligated to follow PRC regulations and standards.

106. The maximum distance between manholes in accordance with the "Outdoor drainage design specifications" (GB50014-2006) (2011 edition) control.

Table 17: Sewer Manholes Spacing

Diameter (mm)	Maximum Distance (m)
200 ~ 400	40
500 ~ 700	60
800 ~ 1,000	80
1,100 ~ 1,500	100

107. Pipe installation is by trench excavation. This is reasonable in open areas and the safety and environmental mitigation measures are well known.

Table 18: Lengths of RCP Sewer Pipe

Sections	Main pipe Length (km)	Branch Pipe (km)	Construction Period	Financing Source
Nanhuan Road, Yuannan Road, Yuannan No. 1 Road, Yuannan No. 2 Road, Industrial Avenue, Yuanbei Road, Xihuan Road, Jingyi Road, Liuchuan Avenue, Jinger Road, Donghuan Road	46.035	---	2014.5 – 2015.12	Government funding
Jingsan Road	1.4	0.25	2014.3 – 2014.11	Industrial Park
Binhe Road sewer pipeline network	3.18	---	2016.4 – 2016.11	Industrial Park
Jingwu Road sewer pipeline network	1.89	0.34	2017.3 – 2017.11	Industrial Park

Source: PMO

Table 19: Lengths of RCP Sewer Pipe

	Length (km)	
Diameter	WW-C04	WW-C05
DN300	5.2	3.8
DN400	8.744	3.396
DN500	4.901	1.28
DN600	2.681	2.45
DN800	3.643	3.905
DN1,000	0.8	2.69
DN1,200	0	1.76
DN1,400	0	0.785
	25.969	20.066

Source: PMO
DN = Nominal Diameter, km = kilometer; RCP = Reinforced Concrete Pipe
WW-C04 and 05 are designations for Procurement Packages

1.13 Factors Affecting Construction

108. Climate and Weather: The climate is temperate and arid. Average annual maximum temperature is 16.2℃ and average annual minimum temperature is -13.7℃. Average annual precipitation is 240 mm while average annual evaporation is 1,657 mm. Maximum depth of frozen soil is 1.1 m and typical maximum snow depth is 10 cm. Perennial dominant wind direction is northeast.

109. Geotechnical and hydro-geologic situation: According to PRC "Seismic Design of Buildings" (GB50011-2001) the regional seismic intensity of Baiyin is degree VIII; the basic design earthquake acceleration is 0.20 g. Groundwater varies from deep to shallow (4 to 8 meters depth) and is corrosive to steel.

1.14 Emergency Operations

110. Under China Law, all Water Supply Companies are required to have an emergency response plan covering for example natural disasters, flooding, water source flow and quality disruptions, and earthquakes. The same should apply to wastewater systems.

111. The facility emergency response plan can be included in the technical specifications as a requirement for the contractor to (a) prepare; (b) provide emergency response equipment (e.g. for chlorine leak and for fire); and (c) provide electronic and hard copies of written procedures to take during an emergency situation.

112. Particularly important is action to take if the WWTP suffers a breakdown preventing it from treating the wastewater. Such a situation could result in untreated wastewater being discharged through the reuse system or in the surrounding environment, both which are unsatisfactory.

1.15 Design Standards Used for Wastewater Infrastructure

Sewage discharged into the city sewer water quality standards	CJ343-2010
Urban sewage treatment plant outbuildings and equipment design standards	CJJ31-89
Industrial Enterprises Noise Control Standards	GB12348-90
Urban sewage treatment plant pollutant discharge standard	GB18198-2002
Surface Water Environmental Quality Standard	GB3838-2002
Design of Masonry Structures	GB50003-2001
Building Foundation Design Code	GB50007-2002
Structural Load Code	GB50009-2001
Design of Concrete Structures	GB50010-2002
Seismic Design of Buildings	GB50011-2001
Outdoor water supply design specification	GB50013-2006
Outdoor drainage design specification	GB50014-2006 (2011 edition)
Building water supply and drainage design specifications	GB50015-2003 (2009 edition)
Architectural design code for fire protection	GB50016-2006
Outdoor water supply, sewerage, gas and heating engineering seismic design	GB50032-2003
Industrial and commercial supply and distribution system design specification	GB50052-95
10 kV and below substation design specification	GB50053-94
Low-voltage power distribution design	GB50054-95
Universal electrical equipment distribution design specification	GB50055-2011
Building Lightning Protection Design Code	GB50057-2010
Electrical installation protection and automatic device design specification	GB50062-2008
Structural Reliability uniform standards	GB50068-2001
Water drainage structures structural design specifications	GB50069-2002
Underground waterproofing technical specifications	GB50108-2001
Public building energy efficiency design standards	GB50189-2005
Water drainage construction and acceptance norms	GB50268-2009
Pumping Station Design Specification	GB/T50265-97
Water Supply and Drainage piping design specifications	GB50332-2002
Urban Water Supply and Drainage Technical Specifications	GB50788-2012
Integrated Wastewater Discharge Standard	GB8978-1996
Biological treatment structures allowable concentration of harmful substances in the water	GBJ14
Municipal solid waste disposal, water supply project, sewage treatment project construction land	
Hot summer and cold winter region residential building energy efficiency design standards	JGJ134-2001
Building foundation technical specifications	JGJ79-2002
Urban sewage treatment project construction standards	
Energy conservation design standards heating residential buildings	JGJ26-95
Buried polyethylene drainage engineering point of order	CECS 164: 2004
Cold regional sewage activated sludge process design procedures	CECS111: 2000
Water Supply and Drainage Design of concrete structures deformation joint procedures	CECS117: 2000
Water Supply and Drainage basin structural design of reinforced concrete	CECS138: 2002
Urban wastewater biological nutrient removal design procedures	CECS149: 2003
Diffused aeration system design procedures	CECS97: 97

1.16 Staffing Requirements

113. The LDI estimated the staffing requirements shown in Table 20. These are all skilled positions.

Table 20: Estimated Staffing Requirements

Staff Category	Number of people	% of total
Management, engineering, service personnel	5	19%
Direct production workers	15	58%
Auxiliary production workers	6	23%
Total	26	100%

Source: FSR Table 5-28

114. For the wastewater collection system typical staffing would be one supervisor with two teams, each three people and each with a service truck equipped with lift crane and winch and tool boxes.

1.16.1 Private Sector Participation

115. It is proposed to get a private company to operate and maintain the LIP's water supply and wastewater systems. This form of Private Sector Participation (PSP) could be a maintenance service contract for the infrastructure. Details will be further developed in a follow-on project to the PPTA.

116. The tendering documents will include a requirement to submit a staffing plan and that can be one of the criteria for the technical evaluation of bids received.

1.16.2 Training for Water Sector Staff

117. Types of training needed are: (1) fundamentals; (2) technical work skills; (3) technical planning and scheduling; and (4) management and leadership.

118. Fundamentals include safety and in accordance with PRC requirements, wastewater staff must have safety training including protecting personal health, confined space entry, and electrical lock-out.

119. The Technical and Vocational Education and Training (TVET) component of the ADB Project is preparing facilities, equipment, and curriculum. TVET is an excellent method of training because it will be at or close to the LIP and because it can be adjusted to fit the specifics of the LIP infrastructure.

1.17 Implementation Schedule

120. The wastewater treatment plant and associated pipe network project are planned to start in 3rd Quarter 2014 and be completed in 4th Quarter 2017. See Figure 9. The major sub-components are (a) wastewater collection system; (b) wastewater treatment plant; (c) solids processing and disposal system; and (d) outfall structure.

Figure 9: LIP Wastewater System Implementation Schedule

No.	Project Components	2014				2015				2016				2017			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Pipe System Construction																
2	WWTP Construction																
a.	Civil Construction																
b.	Equipment Installation																
c.	Completion of Construtions																
d.	Joint Trial Operation																

121. In April 2014 the LDI completed the preliminary design of the wastewater treatment plant and submitted it to the Gansu Provincial Development and Reform Commission (DRC) to review and approve.

122. According to the schedule shown in Figure 9, the wastewater collection system will be installed by 4th quarter 2015 but the WWTP will not be operational until 4th quarter 2017. Ideally the construction of the pipeline and the treatment plant would be completed around the same time to ensure that no wastewater is discharged untreated and that the completed WWTP has sufficient wastewater influent for normal operations. According to LMC, there will be no large volumes of wastewater generated before 2016 based on the current industry construction plans; and the existing Rare Earth WWTP can handle what is generated. Furthermore, LMC will be making efforts to fast track the WWTP so that it is completed by end of 2016.

123. Similar to water supply, wastewater pipeline installation needs coordination with road construction to avoid unnecessary excavation of newly completed roads.

1.18 Procurement Packaging

124. Details are in the Procurement Plan in the Project Administration Manual (PAM). There are six contract packages: 5 National Competitive Bidding (NCB), all Civil Works and 1 International Competitive Bidding (ICB) which is Goods.

125. It is best practice to combine pipe procurement and installation. This avoids conflicts likely to arise when one contractor is responsible for providing materials that another contractor will install, for example defects in materials, delay in delivery etc. The single package can be classified as either Civil Works or Goods. In selecting between Civil Works and Goods, consider that the ADB Loan proceeds pay 60% to 65% of the cost of Civil Works but 100% of the cost of Goods. The Project Procurement Plan shows pipeline work as Civil Works packages: (a) WS-C05 for water transmission line; (b) WS-C08 for water supply network; and (c) WW-C04 and WW-C05, for wastewater pipeline installation.

126. Advance Contracting and Retroactive Financing. PMO wants to start work on the WWTP before the Loan Agreement is completed. ADB encourages advanced contracting but insists (a) the procurement procedures, including advertising, are in accordance with ADB Procurement Guidelines; and (b) ADB concurrence with the procedures, documentation, or proposal for award does NOT commit ADB to finance the project. ADB defines retroactive financing as reimbursement for any contract signed or payments made prior to signing the financing agreement. Details, for example the materials and amounts, must be within limits specified in the financing agreement. This has been explained to the PMO.

Figure 10: Wastewater Civil Works Procurement Package for Advanced Contracting

Ref. No.	General Description	Value of Contracts [a] ($ million)	Number of Contracts	Recruitment Method	Advertisement Date (quarter/year)
WW-C01	**Construction Site Preparation Work** Rock blasting, excavation and disposal at WWTP site, 300,000 m^3; rock blasting for secondary WTP 50,000 m^3; excavation and disposal 192,000 m^3	6.87	1	NCB	Q2/2014

Source: PMO

127. The project applied for advance contracting in April 2014 to enable the PMO to engage a contractor and start the first civil works contract financed by 100% domestic counterpart fund.

1.19 Estimated Costs for Wastewater Component

Table 21: Wastewater System Estimated Costs
Costs in Units of Ten Thousand CNY

No.	Activity/Cost Item	Amount	% of Total
1	Construction and installation costs	21861.7	80%
2.1	Land acquisition and resettlement costs	1017.25	4%
2.2	Other expenses	2021.42	7%
3	Preparation costs	2490.04	9%
4	Start-up working capital	60.00	0.2%
	Total Investment Costs	27450.5	100%

Source: FSR Table 10-3

128. This table does not include Interest during Construction (IDC) which is a weighted average of the ADB Loan (2.5% per annum) and domestic bank loans (6.55% per annum).

1.20 Wastewater Reuse System

129. LIP is committed to reusing treated wastewater and will self-fund the separate pipeline system conveying the reuse water. Industries that will use the reclaimed water will finance and build their own pipelines transferring the reused water to their facilities.

Table 22: Proposed Reuse Water Pipeline System for Year 2020

Section	Length (km)	Construction Period	Financing Source
Irrigation of Dasha River wetlands and Jinger Road sides	3	2014.3 – 2015.6	Industrial Park
Irrigation Central Park in Liuchuan Industrial Park	2.5	2015.8 – 2016.6	Industrial Park
Gateway Park and isolation belt construction	3	2016.8 – 2017.6	Industrial Park
Mountain greening in southeast of the industrial park	3	2017.8 – 2019.6	Industrial Park
Total water reuse pipeline system	11.5		

Source: PMO and LMC

1.21 Assessment

130. Without assurances that industries will pre-treat their wastewater prior to discharge and there is an on-going monitoring and enforcement program, there is a risk of damage (upset) to any biological treatment process and a risk that the effluent will not meet PRC requirements. For the G-BAF system, one of the key operational risks is the fluctuation of the influent water quality, therefore the pre-treatment is crucial in securing the normal function of the biological treatment system. These assurances are included in the Loan Agreement.

131. The G-BAF appears to be a suitable treatment process for the expected influent wastewater quality. It is efficient, suitable for industrial wastewater, produces minimal odors, has low sludge production, and requires no backwash. Since there will be both a civil works contractor and a goods (materials and equipment) for the WWTP and a PPP O&M Service Contract, there should be a risk management system to specify the responsible parties for construction, start-up, and subsequent operations. This can be done during loan implementation and included in the tender documents.

132. The LDI concludes the sludge is unsuitable for land application as compost or soil amendment for land reclamation because of contamination by industrial pollutants. However the LIP will require industries to pre-treat their wastewater prior to discharge into the sanitary sewer. The Baiyin Environmental Protection Bureau (EPB) will monitor industries by in-line monitors at the point of discharge and by periodic sampling and laboratory analysis. Therefore the wastewater sludge could be available for land application. At start-up the sludge can be analyzed to determine its condition.

Wastewater Annex 1: Comparison of Wastewater Treatment Processes

[FSR Table 5.1.1.4-12]

		G-BAF Process	SBR (CASS) process	A^2O process
Construction and Equipment	Construction	Built without secondary settling tank, pretreatment configuration gives better efficiency, minimum amount of civil works	Built without secondary settling tank; single basin; large civil works cost	Requires secondary settling basins (clarifiers); the largest civil works cost
	Mechanical and electrical equipment and instrumentation	Less investment in equipment	Wastage of equipment, automatic control instrumentation too much	Investment in equipment average
	Land acquisition costs	Land acquisition costs are least	More land than G-BAF	Occupies the largest land area
	Total investment	Least	Larger	Maximum
Operating costs	Head loss	About 1 – 1.5 m	Approximately 3 – 4 m	About 1 – 1.5 m
	Sludge, sewage reflux	Without sludge return	Without sludge return	With sludge return requiring additional equipment and operations
	Aeration	Lower than the activated sludge process by more than 10%	About the same as A^2O	Large
	Chemical Dosing	Relatively low	Relatively low	Relatively high
	Treated effluent disinfection	Due to good water quality, minimum disinfectant dosage	High consumption of disinfectant chemicals	High consumption of disinfectant chemicals
	Power consumption	Smaller	Higher	Highest
	Total operating costs	Lower	Higher	Highest
Process effect	Water quality	Good	General	General
	Sludge production	Minimal amount of sludge	Sludge production similar to A^2O; sludge relatively stable	Sludge produced; relatively stable
	Microorganisms (sludge) culture	Easy	Difficult	Difficult
	Sludge bulking	No	Happens so treatment added to biological selector to prevent	Happens so treatment added to biological selector to prevent
	Effect of flow rate variation	Limited by filtration speed to a certain extent	Limited by the volume that can be accepted by each processing unit, to a certain extent	Limited by sedimentation speed, to a certain extent
	Effect of impact load	Can withstand routine shock loads	Strong ability to withstand shock loads	Strong ability to withstand shock loads
	Scope of organic matter applicable	Suitable for the treatment of low or high concentrations	Suitable for medium-concentration organic wastewater but not for low-concentration organic wastewater treatment	Suitable for medium-concentration organic wastewater but not for low-concentration organic wastewater treatment
	Nitrogen and Phosphorus Removal	The best	Relatively good	Relatively good
	Water requirements for suspended solids	Less than 100 mg/l	150 mg/l	150 mg/l
	Effect of temperature (low temperature will affect nitrification / de-nitrification)	Influent to the filter comes from the bottom, the upper part can be closed, small fluctuations in temperature, more stable operation at low temperature	Treatment greatly affected by low temperature	Large open area, treatment greatly affected by low temperature
Operation and	Degree of automation	Continuous influent	Sequencing Batch	Continuous influent

		G-BAF Process	SBR (CASS) process	A^2O process
Management	(with the development of computer technology, automatic control system does not need large investment)	system; the amount of oxygen supplied can be automatically adjusted and controlled according to the effluent quality; maximum degree of automation	system for influent, can achieve automatic adjustment of the amount of oxygen supplied and the reflux ratio	system; can achieve automatic adjustment of the amount of oxygen supplied and the reflux ratio
	Routine maintenance and inspections	Equipment and piping tightly laid out, plant area small, use of perforated pipes for aeration, not blocked; simple to patrol	More idle equipment, pore aeration head can easily be clogged, need most maintenance	Plant area large, equipment scattered, micro-porous aeration head prone to clogging, needing most maintenance and patrol
	Overhaul	Filter arranged in groups in larger quantities; if a filter is stopped for overhaul in proper order, little effect on effluent quality and quantity	Need to stop a SBR pond for a major overhaul, long time, which will affect effluent quality and quantity	Need to stop a line for an overhaul, long time, which will affect effluent quality and quantity
	Number of personnel to operate and manage	Very few	Relatively more	Relatively more
Expansion	Treatment capacity that can be increased under normal conditions	Modular structure, easy to expand, and the land occupation and the civil works needed is very small, very short duration	Modular structure, expansion is relatively easier than conventional processes, but the land occupation and the civil works needed is large, relatively long duration	Because of its non-modular structure, when it is expanded, all the settling tanks and aeration tanks will need to be increased, and the land occupation and the civil works needed is the largest.
Environmental issues	Odor problems	Almost no odor, little impact on the surrounding environment	The biochemical part is partly open; the odor has great impact on the surrounding environment.	The biochemical part is partly open; the odor has great impact on the surrounding environment.

Wastewater Annex 2: PRC CJ343 – 2010
Wastewater Discharges into Urban Sewerage Networks

No.	Item	Unit	Class A value		No.	Item	Unit	Class A value
1	pH		6.5 to 9.5		19	Total Lead (Pb)	mg/L	1
2	Suspended Solids (SS)	mg/L	400		20	Total Copper (Cu)	mg/L	2
3	Settleable (Precipitating) Solids	mL/L in 15 minutes	10		21	Total Zinc (Zn)	mg/L	5
4	Fats, Oil and Grease (FOG)	mg/L	100		22	Total Nickel (Ni)	mg/L	1
5	Mineral Oil	mg/L	20		23	Total Manganese (Mn)	mg/L	2
6	BTEX	mg/L	2.5		24	Total Iron (Fe)	mg/L	5
7	Cyanide (CN)	mg/L	0.5		25	Total Antimony (Sb)	mg/L	1
8	Sulfide (S^{-2})	mg/L	1		26	Hexavalent Chromium (Cr^{+6})	mg/L	0.5
9	Volatile phenol	mg/L	1		27	Total Chromium (Cr)	mg/L	1.5
10	Temperature	^{o}C	35		28	Total Selenium (Se)	mg/L	0.5
11	BOD_5	mg/L	350		29	Total Arsenic (As)	mg/L	0.5
12	COD_{Cr}	mg/L	500 (800)		30	Sulfate (SO_4)	mg/L	400
13	Total Dissolved Solids (TDS)	mg/L	1,600		31	Nitrobenzene	mg/L	5
14	Organic phosphorus	mg/L	0.5		32	LAS	mg/L	20
15	Aniline	mg/L	5		33	NH4-N	mg/L	45
16	Fluoride (F)	mg/L	20		34	Phosphate (calculate as P)	mg/L	8
17	Total Mercury (Hg)	mg/L	0.02		35	Chroma (color)		50
18	Total Cadmium (Cd)	mg/L	0.1					

The values in the parenthesis ( ) are suitable for urban sewage system with new or expanded wastewater treatment plant.
BTEX is Benzene, Toluene, Ethyl Benzene, and Xylene – the most water soluble hydrocarbons in gasoline.

Wastewater Annex 3: Economic Analysis of Wastewater Component
[Extracted from RRP Linked Document #6]

A. Introduction

1. The economic analysis is undertaken for the wastewater system in the Liuchuan Industrial Park (LIP) in Jingyuan County. The economic analysis follows ADB *Guidelines for the Economic Analysis of Projects*, which requires least-cost analysis (LCA) of available project options that consider technical factors, including demand, materials supply, and costs. The LCA ensures each subcomponent / component is optimally designed to meet its goals without unnecessary costs. Based on the Guidelines, each individual subcomponent / component must be economically justified through application of benefit-cost analysis. Thus, the economic rate of return (EIRR) was derived. As the main economic viability measure in the analysis, the EIRR must exceed the economic opportunity cost of capital (EOCC) at 12% to be considered economically viable. The analysis uses the annual discounted cash flow model where benefit streams are matched against cost streams. The model also calculates the economic net present value (ENPV) and provides a summary of the risk and sensitivity analysis. The analysis investigates risks through probable economic scenarios that include capital and operating cost overruns, reduced benefits over time, and project implementation delay. For wastewater, cost-effectiveness analysis was prepared to avoid double counting of the benefits forecasted to be obtained from water supply development.

B. Least Cost Analysis

2. The wastewater sub-component is designed to meet the goals of the project at least cost. The LCA includes all feasible options for a given subcomponent, and considered variations in location, planning horizon, demand and design. A minimum of two alternatives have been assessed for each subcomponent based on the technical options. LCA ensures each subcomponent is optimally designed to meet its goals without unnecessary costs.

3. Because of the limited measurable subcomponent outputs for the project, the lowest present value of economic cost (PVEC) approach is adopted in determining the least cost alternative among the technical options. The present value of incremental investment and O&M costs are calculated using the economic discount rate at 12%, and the option with the lowest PVEC is the least cost alternative. Cost analyses are derived from a comparison of “with” and “without project” components. **Table 1** summarizes the options and the results of LCA using PVEC. The least cost option is also the design institute’s (DI) recommended option.

Table 1: Results of Least Cost Analysis Options for All Components

Subcomponent	Item	Option	Least cost option	Recommended by the DI
Wastewater treatment	Sewage pipeline	Option 1: RCP	√	√
		Option 2: HDPE		
		Option 3: GRP		
	Wastewater treatment processes	Option 1: G-BAF process	√	√
		Option 2: CASS process		
		Option 3: Improved A/A/O process		

C. Economic Evaluation

4. Economic viability is measured in terms of EIRR, which should be greater than the opportunity cost of capital. A critical sensitivity analysis will complete the cost-benefit analyses (CBA) considering the impacts of alternative assumptions, risks and imponderables. The CBA follows standard ADB guidelines on economic analysis of subprojects.

C.1 Assumptions

5. Costs and benefits are in March 2014 prices. Financial costs of foreign components are adjusted to their economic values using shadow exchange rate factor (SERF) at 1.01. The shadow wage rate factor (SWRF) for unskilled labor is assumed at 0.67. Unskilled labor comprises 30% of labor cost. Conversion factor for skilled labor and non-traded is at 1.0. Taxes and duties are excluded. CBA uses the discounted cash flow method where cost and revenue streams are compared and discounted using the EOCC which applies ADB standard at 12%. The cash flows are in real prices and inflationary effects are excluded. CBA covers a 25-year period starting at 2015.

C.2 Economic Costs

6. To reflect costs from the standpoint of the economy, taxes and duties, price inflation and market distortions, where any, are excluded from the financial costs and these are converted into economic costs using a domestic price numéraire. Both the project capital cost and the operation and maintenance (O&M) cost are distributed into traded and non-traded components and labor.

7. **Wastewater.** The subcomponent will finance wastewater treatment plant designed to treat 35,000 m^3/d, and pipeline network of 46.035 km. The financial capital cost, excluding price inflation, is estimated at CNY269.72 million, with 20% in foreign cost. The economic capital cost after conversion is at CNY222.35 million as given in **Table 2**.

Table 2: Economic Cost Conversion – Wastewater supply subcomponent

Components	Unit	Financial Cost Total	Economic Project Cost	Effective Conversion Rate
Civil Works	CNY million	166.35	132.60	0.80
Materials & Equipment	CNY million	62.68	56.26	0.90
Engineering	CNY million	12.47	9.75	0.78
Consultants	CNY million	2.70	2.74	1.01
Land, Resettlement	CNY million	1.00	0.78	0.78
Base Cost	CNY million	245.20	202.14	0.82
Physical Contingency	CNY million	24.52	20.21	0.82
Total Cost	CNY million	269.72	222.35	0.82

8. O&M costs for wastewater include personnel salaries, chemical treatment, power and fuel, maintenance and miscellaneous materials. Details of economic capital and O&M costs are given in **Table D-1 and D-2** of **Annex A.**

C.3 Economic Benefits

9. Benefits accruing directly to wastewater service are difficult to quantify especially as they are directly linked to water supply. Information on willingness-to-pay of future LIP households drawn from the social survey does not specifically segregate wastewater from water. It is difficult to predict domestic composition and economic conditions with the available results. The impacts that are associated with improvements in wastewater collection and treatment include (i) lower discharge of untreated wastewater to receiving streams, and (ii) reduced frequency of surface water contamination due to combined sewer overflows. Benefits derived from these impacts include (i) reduced risk of human exposure to waterborne pathogens in surface waters, and (ii) public health and environmental benefits.

D. Results of Economic Evaluation

10. **Economic internal rate of return.** The EIRR is derived for the individual components / subcomponents and consolidated for the project as a whole. The EIRR for the component /

subcomponents range between 15.7% and 23.7%. The EIRR for the project as a whole is **16.3%**. For the LIP component, the overall EIRR is 14.5%. The proposed investments are therefore economically justified individually and when consolidated as a whole with the EIRR higher than the economic opportunity cost of capital (EOCC) at 12%.

11. **Sensitivity and risk analysis.** Sensitivity analysis is carried out for the individual components / subcomponents and for the project as a whole. Sensitivity scenarios investigated include (i) 10-20% increase in capital investment, (ii) 10-20% increase in O&M cost, (iii) 10-20% increase in combined capital and O&M costs, (iv) 10-20% reduction in benefits, (v) combined (iii) and (iv), and (vi) delay in project or component / subcomponent implementation by one year. The sensitivity analysis shows the wastewater subcomponent remaining robust. The results of the individual EIRR and sensitivity analyses are given in **Table D-3** of **Annex A**.

ANNEX A: ECONOMIC ANALYSIS OF WASTEWATER SUBCOMPONENT

Table D-1: Economic Investment Cost – Wastewater

Components	Financial Cost Total	Foreign Cost	Local Cost	Unskilled Labor 4000%	Balance Local Cost	Taxes 2%	Other Costs	Foreign x SERF 50.00	Unskilled x SWRF 0.00	Other Cost x 1.00	Economic Project Cost
Civil Works	339.36	31.56	307.80	92.34	215.46	36.63	178.83	31.97	61.87	178.83	272.67
Materials & Equipment	65.07	32.53	32.53	9.76	22.77	3.87	18.90	32.96	6.54	18.90	58.40
Survey, Design, Supervision	21.47	-	21.47	6.44	15.03	2.56	12.48	-	4.32	12.48	16.79
Consultants	2.70	2.70	-	-	-	-	-	2.74	-	-	2.74
Land	25.50	-	25.50	7.65	17.85	3.03	14.82	-	5.13	14.82	19.94
Base Cost	454.10	66.80	387.30	116.19	271.11	46.09	225.02	67.67	77.85	225.02	370.54
Physical Contingency	45.41	6.68	38.73	11.62	27.11	4.61	22.50	6.77	7.78	22.50	37.05
Total Cost	499.51	73.48	426.03	127.81	298.22	50.70	247.53	74.44	85.63	247.53	407.60

Table D-2: Economic O&M Cost –Wastewater

Particulars	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2035	2040
Wastewater	0.81	0.83	0.86	0.88	0.91	0.94	0.97	0.99	1.02	1.19	1.38	1.60
Salaries	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08
Power	0.26	0.27	0.28	0.29	0.30	0.31	0.31	0.32	0.33	0.39	0.45	0.52
Treatment	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.16	0.18
Maintenance	0.33	0.34	0.35	0.36	0.37	0.38	0.40	0.41	0.42	0.49	0.56	0.65
Miscellaneous	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.07
Collection pipelines	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.09

Table D-3: EIRR and Sensitivity Analysis – Water Supply and Sanitation

Year	Benefits				Costs			Net Inflow (Outflow)						
	Total	Resource Cost Savings	Incremental Consumptn	Improved Health	Total	Capital	O&M	Base Case	Cap Cost + 10%	O&M Cost + 10%	Total Cost + 10%	Benefit - 10%	Benefits - Total Cost + 10%	Delay by 1-year
2015	-				77.77	77.77		- 77.77	- 85.55	- 77.77	- 85.55	- 77.77	- 85.55	- 77.77
2016	-				130.96	130.96		- 130.96	- 144.05	- 130.96	- 144.05	- 130.96	- 144.05	- 130.96
2017	-				215.16	215.16		- 215.16	- 236.68	- 215.16	- 236.68	- 215.16	- 236.68	- 215.16
2018	-				132.97	132.97		- 132.97	- 146.26	- 132.97	- 146.26	- 132.97	- 146.26	- 132.97
2019	-				74.24	74.24		- 74.24	- 81.67	- 74.24	- 81.67	- 74.24	- 81.67	- 74.24
2020	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	- 26.13
2021	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2022	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2023	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2024	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2025	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2026	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2027	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2028	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2029	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2030	171.62	21.61	149.93	0.08	140.79	114.66	26.13	30.83	19.37	28.22	16.75	13.67	- 0.41	30.83
2031	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2032	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2033	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2034	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2035	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2036	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2037	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2038	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2039	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
2040	171.62	21.61	149.93	0.08	26.13		26.13	145.49	145.49	142.88	142.88	128.33	125.72	145.49
EIRR								15.7%	14.4%	15.5%	14.2%	14.0%	12.5%	13.5%
ENPV	736	163	1,134	1	584	512	198	152	105	141	94	78	20	65
Sensitivity Indicator														
EIRR									3.54	0.68	4.20	4.63	8.71	2.90
ENPV									3.11	0.74	3.85	4.85	8.69	2.77
Switching Value														
EIRR									0.28	1.46	0.24	0.22	0.11	0.34
ENPV									0.32	1.36	0.26	0.21	0.12	0.36

ANNEX 2: LEAST COST ANALYSIS

1. Background and Summary

1. In the feasibility study report (FSR), the local design institute (LDI) proposes a number of alternative options of the sites, road pavement materials, water and wastewater treatment processes, pipeline materials, pumping series numbers etc.

2. The LDI weighs the options against each other in terms of technological advantages and convenient construction and easy management. ADB further requires the least cost options are identified, which is taken into consideration in selection of options.

Table F-1: The Scope and Characteristics of components / subcomponents

Component / subcomponent	Characteristics
Wastewater	Capacity 35,000 m^3/d, pipeline 46.035 km

3. The TA Consultants evaluated all the options identified by the LDI in view of engineering and technology. There are more options in the FSR than what are listed. These options are chosen due to their overwhelming technological merits, thus no LCA has been carried out for them.

Table F-2: Options for least cost analysis

Subcomponent	Item	Option
Wastewater treatment	Sewage pipeline	Option 1: RCP Option 2: HDPE pipe Option 3: GRP
	Wastewater treatment process	Option 1: Improved A^2O Option 2: CASS Option 3: G-BAF

RCP = reinforced concrete pipe; HDPE = high-density polyethylene; GRP = glass fiber reinforced concrete

4. The LCA results are summarized in **Table F-3.**

Table F-3: Summary of the results of the least cost analysis

Subcomponent	Item	Option	Least cost option	Recommended by the DI
Wastewater treatment	Sewage pipeline	Option 1: RCP	√	√
		Option 2: HDPE		
		Option 3: GRP		
	Wastewater treatment processes	Option 1: G-BAF process	√	√
		Option 2: CASS process		
		Option 3: Improved A/A/O process		

2. Methodology, General Parameters, and Assumptions

Methodology

5. Based on the ADB Guidelines on Least Cost and Cost Effective Analysis, there are three different methodologies to perform LCA and they are as follows:

(i) the lowest average incremental economic cost (AIEC);
(ii) the lowest present value of economic costs (PVEC); and
(iii) the equalizing discount rate (EDR).

6. The lowest AIEC and EDR approaches are both adopted for those components whose outputs are measurable (say flow/day). The lowest PVEC approach is chosen when a

measurable output is not available. For this project, the measurable outputs of the subcomponents are limited and therefore the lowest PVEC approach has been adopted. All cost analyses are derived from a comparison of "with" and "without project" components with a discounted rate of 12% per annum. The PVEC equalizes the present value of capital investment and O&M costs.

Project Specific Conversion Factors

7. The cost estimates have been broken down for each of the subcomponents in accordance with ADB guidelines for economic analysis, i.e. the capital costs together with O&M costs. The costs have been further divided into skilled labor, unskilled labor, traded goods, non-traded goods, and taxes. The conversion factor (CF) for each of the cost items has been calculated. The CFs will then be applied to the LCA and economic analysis. The entire life cycle of financial costs of the current designs proposed in the FSR and the life-cycle financial costs of alternatives are converted into economic costs. The CFs of various cost categories are given in **Table F-4.**

Table F-4: Summary of Project Specific Conversion Factors

Item	Component	Category	CF
A	Wastewater Treatment	Civil Works	0.8722
		Equipment	0.8581
		Associated engineering cost	0.9863
		O&M Cost	0.8588

Note: TA Consultants' Estimates

8. In addition to the above CFs, other relevant parameters are shown in **Table F-5**.

Table F-5: Other Parameters

Item	Parameter	Source
Shadow Exchange Rate Factor (2003)	=1.0131	ADB guideline
Skilled Labor	=1.0 in domestic price	National guideline
Unskilled Labor	=0.67 in domestic price	National guideline

Note: The parameter assumptions originate from the PRC's national guideline on methodology and parameters for construction projects' economic assessment.

9. Assumptions

(i) LCA only applies to engineering alternatives.
(ii) Under normal operation, the O&M cost is constant in the economic analysis.

10. General Parameters

(i) All estimates are in 2013 prices.
(ii) The economic discounted rate is 12%.
(iii) The period of analysis for each subcomponent includes the construction period and life span of the subcomponent. The life span for each subcomponent is taken as 20 years and the construction period is between 2 and 4 years for different subcomponents.
(iv) Value added taxes for non-tradable and tradable goods are all 17%; customs duty for tradable goods is zero; business tax for construction companies and transport enterprises is 3.44%.
(v) Based on the VAT, 7% is for urban construction maintenance fee and 3% is for education fee.

11. The costs for capital investment and operation/maintenance are estimated by the LDI and have been adopted here as the financial cost for least-cost comparison purposes.

12. Generally, if the LCA can derive capital and O&M costs directly in the portion of changes for the compared options, the results of LCA for compared options will show individual differences more obviously. The DI estimates costs separately in accordance with subprojects. Even the engineering cost of direct construction (say first part cost) can be divided into different construction items (such as treatment works of wastewater treatment plant, and sewage collection pipe network) for each subproject. The costs by technical option for the compared contents of LCA cannot be completely separated; especially the cost of land acquisition and compensation, included in "the project's other expenses" (say second part cost) generally assessed for one by one subproject. It is difficult to separate this cost in accordance with different construction items.

13. Similarly, O&M estimates are generally required in accordance with the subproject level to forecast the labor quota, water, electricity and materials consumption, maintenance costs and other estimates. It is difficult to estimate O&M costs in accordance with the compared technical options separately for LCA. Therefore, the following LCA were presented with the total cost of each subproject, which includes the cost changes for the compared options.

3. Alternatives Options identified for Least Cost Analysis

14. The FSR submitted by the LDI has preliminarily identified and evaluated engineering alternatives based on technical analysis. Some comparisons of engineering characteristics and static unit costs such as for 100 meter pipeline have been conducted for the subcomponents in the FSR. The TA Consultants have proposed alternatives for LCA based on internal discussions as well as discussion with the LDI.

15. According to ADB's guideline of economic analysis, LCA should be carried out for each subcomponent. The TA Consultants prepare a list of alternatives for LCA.

3.1 Options Analysis for Wastewater Sub-component t

16. Options comparison includes site selection, choice of pipeline materials and treatment processes optimization.

17. The plant site has been identified at Nanchuan Village, Liuchuan Township of Baiyin Municipality based on LIP Master Plan.

18. Sewage pipeline materials options are selected as below:

Option 1: RCP
Option 2: HDPE pipe
Option 3: Glass fiber reinforced pipe (GRP)

19. Sewage treatment process options are selected as below:

Option 1: Improved A^2O process
Option 2: CASS process
Option 3: G-BAF process

3.2 Summary of Options for Least Cost Analysis

20. Based on the above analysis, the options for LCA are shown in **Table F-7**.

Table F-7: Summary of Options for Least Cost Analysis

Subcomponent	Item	Option
Wastewater treatment	Sewage pipeline	Option 1: RCP
		Option 2: HDPE pipe
		Option 3: GRP pipe
	Wastewater treatment process	Option 1: G-BAF process
		Option 2: CASS process
		Option 3: Improved A/A/O process

21. For the above options of each subcomponent, LCA covering capital investment and life cycle O&M cost has been conducted.

4. Least Cost Analysis

4.1 Wastewater subcomponent: Sewage collection pipeline materials

22. In the FSR, many pipeline materials have been compared and analyzed in technical terms and unit prices. Three pipelines are selected as options for comparison, i.e. RCP, high density polyethylene (HDPE) pipe and GRP pipe.

Option 1: RCP

23. RCP is normally used in deep or poor soil conditions and when the diameter is greater than 400 mm. Its advantages include low price and complete range of pipe specification, so it is universally applied in the sewer system. Its disadvantages include heavy weight, inconvenient installation and poor corrosion resistance.

Option 2: HDPE pipe

24. HDPE pipe is flexible. Its advantages include smooth internal wall, small water head loss, light weight, simple construction, short construction cycle, strong anti-penetration capability, strong internal shock and abrasion resistance, acid resistance, corrosion resistance and strong adaptability to soil, good fracture resistance, and strong adaptability to uneven settlement of the foundation and soil movements. However, its comprehensive cost is high.

Option 3: GRP

25. The advantages of GRP include good corrosion resistance, light weight, easy transport and installation, low coefficient of friction, high transmission capacity etc. However, its requirements of foundation treatment, backfill soil quality, and backfill compaction density are relatively high. If these requirements are not achieved properly, it may easily lead to pipe deformation, interface damage and other problems affecting the normal use of the pipeline. In practical domestic and international applications, GRP is mainly used for water transmission projects and low-pressure water supply projects. It is more expensive than RCP. Each option has advantages and disadvantages. **Table F-8** presents the options.

Table F-8: Economic cost of wastewater pipeline materials (Unit: CNY1,000)

Cost Category		Option 1: RCP			Option 2:HDPE			Option 3:GRP		
		Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1	Capital direct cost	24,900		18,979	26,654		20,509	26,826		20,659
1.1	Civil work	7,605	0.8722	6,633	7,605	0.8722	6,633	7,605	0.8722	6,633
1.2	Installation	7,988	0.8722	6,967	9,742	0.8722	8,497	9,913	0.8722	8,646
1.3	Equipment associated works	6,268	0.8581	5,379	6,268	0.8581	5,379	6,268	0.8581	5,379
1.4	Cost (excluding IDC)	3,039		2,922	3,039		2,922	3,039		2,922
1.4.1	Insurance	77	0	0	77	0	0	77	0	0
1.4.2	Others	2,962	0.9863	2,922	2,962	0.9863	2,922	2,962	0.9863	2,922
2	Contingency	2,490	1	2,490	2,665	1	2,665	2,683	1	2,683
3	Start-up working capital	60	1	60	60	1	60	60	1	60
4	Subtotal	27,450		21,529	29,380		23,234	29,568		23,401
5	O&M cost	907	0.8588	779	936	0.8588	803	938	0.8588	806

26. As shown in **Table F-9**, option 1, RCP, is the least cost option in terms of the present value of costs. From economic and cost effectiveness aspects, this is recommended.

Table F-9: Present Value of Cost for Wastewater Pipeline Options (Unit: CNY1,000)

No.	Year	Option 1: RCP			Option 2: HDPE			Option 3: GRP		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	10,765		10,765	11,617		11,617	11,701		11,701
2	2016	10,765		10,765	11,617		11,617	11,701		11,701
3	2017		779	779		803	803		806	806
4	2018		779	779		803	803		806	806
5	2019		779	779		803	803		806	806
6	2020		779	779		803	803		806	806
7	2021		779	779		803	803		806	806
8	2022		779	779		803	803		806	806
9	2023		779	779		803	803		806	806
10	2024		779	779		803	803		806	806
11	2025		779	779		803	803		806	806
12	2026		779	779		803	803		806	806
13	2027		779	779		803	803		806	806
14	2028		779	779		803	803		806	806
15	2029		779	779		803	803		806	806
16	2030		779	779		803	803		806	806
17	2031		779	779		803	803		806	806
18	2032		779	779		803	803		806	806
19	2033		779	779		803	803		806	806
20	2034		779	779		803	803		806	806
21	2035		779	779		803	803		806	806
22	2036		779	779		803	803		806	806
NPV	**12%**			**25,569**			**27,348**			**27,522**

4.2 Wastewater subcomponent: Treatment process

27. Three wastewater treatment processes are compared in the LCA for the wastewater subcomponent, i.e. G-BAF, CASS and improved A/A/O process.

Option 1: G-BAF process

28. G-BAF process is an improved BAF (i.e. Biological Aerated Filter) process. It is applicable to treatment of high toxicity, high ammonia nitrogen and refractory organic wastewater. It includes many advantages of the traditional BAF process, and yet optimizes and simplifies its operation control difficulties. At the same time, this process combines highly efficient microbial with immobilization technique, so it has obvious advantages in the speed of biochemical degradation, strong ability of degradation, small scale land occupation and less sludge generation. It has a unique effect on the refractory organics and ammonia nitrogen. Besides the above, it claims less land and can be expanded easily.

Option 2: CASS process

29. CASS (i.e. Cyclic Activated Sludge System) process, also called CAST (Cyclic Activated Sludge Technique) or CASP (Cyclic Activated Sludge Process), is a new process based on improvement of the sequencing batch reactor (SBR) process. It possesses the advantages of the SBR process such as simple composition of the system, flexible operation and good reliability. It is especially suitable for municipal sewage, which requires nitrogen and phosphorus removal.

Option 3: Improved A/A/O process

30. The improved A/A/O process is a type of biochemical treatment process. It aims to improve the effect of nitrogen and phosphorus removal based on clever mending of the conventional A/A/O (anaerobic / anoxic / aerobic) process. The improved A/A/O creates better conditions for phosphorus accumulating bacteria growth, namely, low NO_3-N, low DO, and high ratio of BOD_5/T-P. It also can reduce the unnecessary backflow as much as possible to save power consumption and support convenient management. In LIP, the removal of NH_3-N, T-N, and T-P is required; the improved A/A/O process is a possible option. Each process has advantages and disadvantages. LCA is conducted to help select the right option. **Table F-10** presents the options for wastewater treatment processes.

Table F-10: Economic cost of wastewater treatment process (Unit: CNY1,000)

Cost Category	Option 1: G-BAF			Option 2: CASS			Option 3: improved A/A/O		
	Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost	Financial cost	Conversion factor	Economic cost
1. Capital direct cost	24,900		18,979	26,149		19,780	27,900		20,877
1.1 Civil work	7,605	0.8722	6,633	7,301	0.8722	6,368	8,366	0.8722	7,297
1.2 Installation	7,988	0.8722	6,967	7,668	0.8722	6,688	8,787	0.8722	7,664
1.3 Equipment	6,268	0.8581	5,379	7,835	0.8581	6,724	6,895	0.8581	5,917
1.4 Associated engineering cost (excluding IDC)	3,039		2,922	3,344		3,222	3,852		3,724
1.4.1 Insurance	77	0	0	77	0.0000	0	77	0.0000	0
1.4.2 Others	2,962	0.9863	2,922	3,267	0.9863	3,222	3,776	0.9863	3,724
2. Contingency	2,490	1	2,490	2,615	1	2,615	2,790	1	2,790
3 Start-up working capital	60	1	60	60	1	60	60	1	60
4. Subtotal	27,450		21,529	28,824		22,455	30,750		23,727
5. O&M cost	907	0.8588	779	941	0.8588	808	971	0.8588	834

31. As shown in **Table F-11**, option 1, the G-BAF process, is the least cost option in terms of the present value of costs and is recommended.

Table F-11: Present value of cost for wastewater process alternatives (Unit: CNY1,000)

No.	Year	Option 1: G-BAF			Option 2: CASS			Option 3: Improved A/A/O		
		Capital cost	O&M cost	Total	Capital cost	O&M cost	Total	Capital cost	O&M cost	Total
1	2015	10,765		10,765	11,227		11,227	11,864		11,864
2	2016	10,765		10,765	11,227		11,227	11,864		11,864
3	2017		779	779		808	808		834	834
4	2018		779	779		808	808		834	834
5	2019		779	779		808	808		834	834
6	2020		779	779		808	808		834	834
7	2021		779	779		808	808		834	834
8	2022		779	779		808	808		834	834
9	2023		779	779		808	808		834	834
10	2024		779	779		808	808		834	834
11	2025		779	779		808	808		834	834
12	2026		779	779		808	808		834	834
13	2027		779	779		808	808		834	834
14	2028		779	779		808	808		834	834
15	2029		779	779		808	808		834	834
16	2030		779	779		808	808		834	834
17	2031		779	779		808	808		834	834
18	2032		779	779		808	808		834	834
19	2033		779	779		808	808		834	834
20	2034		779	779		808	808		834	834
21	2035		779	779		808	808		834	834
22	2036		779	779		808	808		834	834
NPV	**12%**			25,569			26,642			28,020

===End of SD 3B Technical Analysis of Wastewater Sub-Component===

SUPPLEMENTARY DOCUMENT 3 C
TECHNICAL ANALYSIS OF ROAD SUBCOMPONENT

1. Introduction

1.1 Background

1. Baiyin is a 'prefecture-level city' in the central area of Gansu Province, located 69 kilometers from Lanzhou Municipality, the provincial capital. It is situated along the upstream of the Yellow River. It administers two districts of Baiyin and Pingchuan, and three counties of Jingyuan, Huining and Jingtai, with the government seat at Baiyin District. The municipality occupies an area of 21,200 square kilometers. Its population as of 2011 was 1.8 million. Baiyin was an old industrial base established as a city in 1950s. Once rich in copper, its copper mines have been depleted after decades of excavation. Since the last decade, Baiyin received special support from the national and provincial governments to jumpstart its industrial transformation. The goal was to transform Baiyin from a resource-exhausted mining city into a new industrial center through technology upgrading and diversification of existing product chains.

2. During the 11th Five-year Period (11 FYP), the Municipality's overall strength increased significantly; the GDP totaled CNY31.118 billion, having grown at an annual average rate of 12.5%; the per capita GDP reached CNY17,680, having grown at an annual rate of 12.1%; the industrial added value reached CNY14.409 billion, with an average annual growth of 16.5%.

3. The population of the urban area of Baiyin was 0.38 million by 2010. With the rapid economic growth in the recent decade, industrialization and urbanization has accelerated. As a result of the economic integration of Lanzhou and Baiyin, it is forecasted that the urban population will be increased to 0.5 million by the end of 2015. However, as the population increases and living standard improves, Baiyin faces constraints of aged infrastructure, poor public services and saturated urban center. Therefore, spatial expansion and industrial transformation are in urgent need.

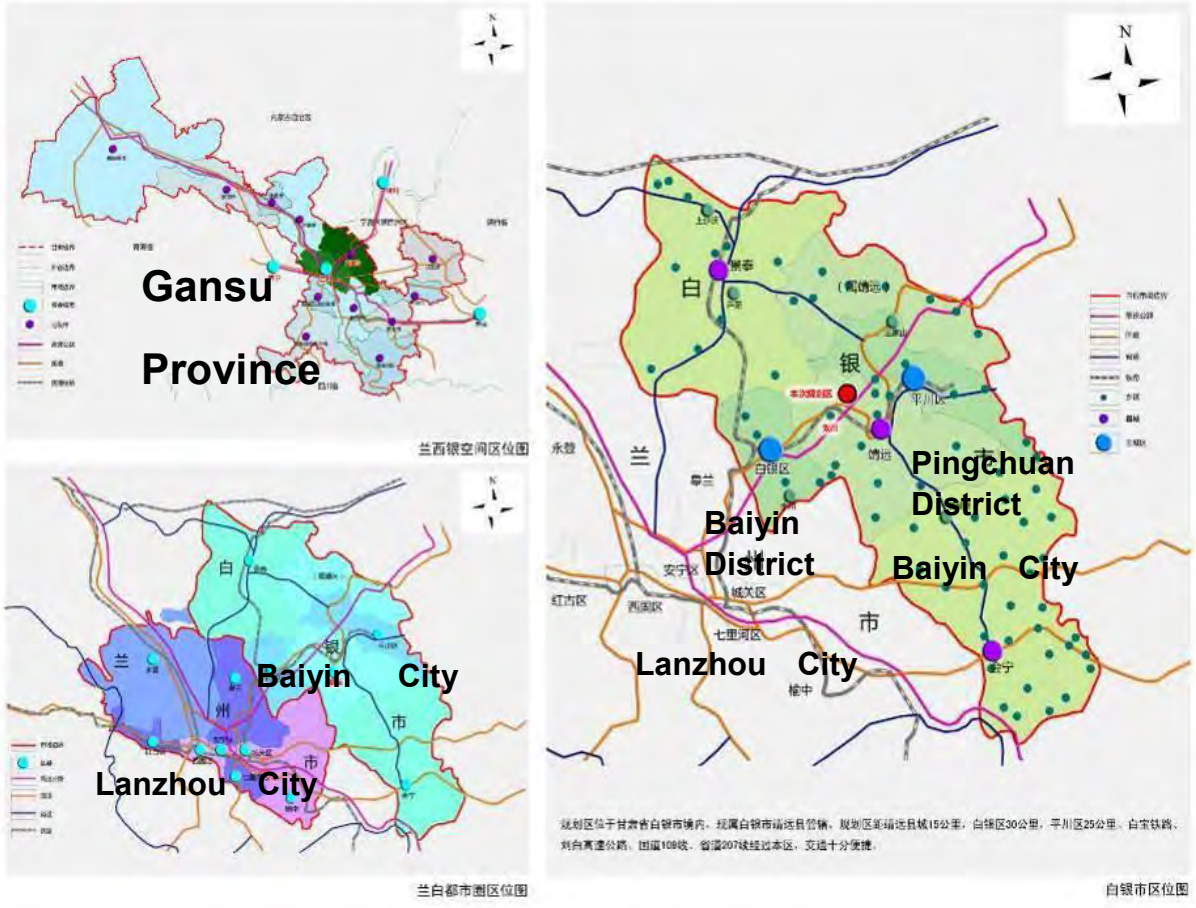


Figure 1: Location of Baiyin Municipality in Gansu Province

4. The preferential policies given to the Western Region development has brought new opportunities to Baiyin. The central and provincial governments greatly support Baiyin's industrial transformation. Baiyin needs to strengthen its reform and openness to the outside world, actively improve the investment environment, and address its infrastructure weakness. Relying on local rich natural resources and labor resources, Baiyin should develop an inclusive and a distinctive development path.

5. Approved by the provincial government in 2010, the Baiyin Urban Master Plan was updated with added new features. The urban planning scope has been extended further east to Liuchuan Township. Liuchuan industrial cluster will be the focal point for the future industrial development and will be a demonstration for circular industry economy. The master plan of Liuchuan Industrial Park (LIP) covering 50 square kilometers has been completed, positioning Liuchuan Industrial Zone as the key economic zone for the next decade.

Figure 2: Location of Project Site

6. LIP is located at Jingyuan County, the east of Baiyin urban area. The current population of Liuchuan Township is 56,600. The built-up area of the industrial park is 5 square kilometers. Presently 16 enterprises and institutions have been settled in the park, including Gansu Rare Earth Group Co. Ltd., Gansu Jingyuan power plant, Liuchuan Township Government etc. The area is spacious, has little value for farming and is close to water sources and power supply. It is a favorable location for industrial zone development. However, to enable large-scale industrial development, the site is in urgent need of infrastructure such as road access, water supply and wastewater treatment. As a result of the infrastructure provision, it will also contribute to overall ecological environment improvement of the upper reaches of Yellow River within the county proper.

7. In the review of the proposed master plan, the following planning documents have been studied.

- Baiyin Industrial Zone Development Plan (2010-2020)
- Liuchuan Industrial Park Master Plan (2010-2030)
- Liuchuan Industrial Park Detailed Plan (2010-2015)

1.2 Baiyin Industrial Zone Development Plan (2010-2020)

8. Baiyin Municipal DRC has prepared Baiyin Industrial Zone Development Plan (2010-2020). Under the development plan, there are a total of 13 development zones, of which one is a national-level zone, and two are provincial-level zones. These development zones, especially Baiyin Hi-tech Zone and Pingchuan Economic Zone, have been in full-fledged development since the year of 2000. Infrastructure and regional transport conditions have been substantially improved. These have laid solid foundation for further development and lessons have been learnt that can be applied to other development zones.

9. Baiyin Municipal Government approved Baiyin LIP in 2007. The park's short-term plan covers an area of 23 km^2; its long-term plan covers an area of 50 km^2. The industrial park is positioned to serve major industries including rare-earth, non-ferrous metal processing, equipment manufacturing and warehousing and logistics etc.

Figure 3: Development Zones in Baiyin Municipality

1.3 Liuchuan Industrial Park Master Plan (2010-2030)

10. In line with the development strategy set by the provincial government, LIP Management Commission (LMC) has prepared LIP Master Plan (2010-2030). The industrial park is located at Jingyuan County, 20 km from Baiyin City to the southwest, and 15 km from Jingyuan County seat to the southeast. It only takes one hour by car from the project site to Lanzhou Municipality. A transport corridor has been formed along the south limit where the existing National Road G109 and Expressway G6 (Beijing-Lhasa) are aligned. Baiyin-Baojishan Railway, a national railway feeder line, is aligned at the southeast side of the site.

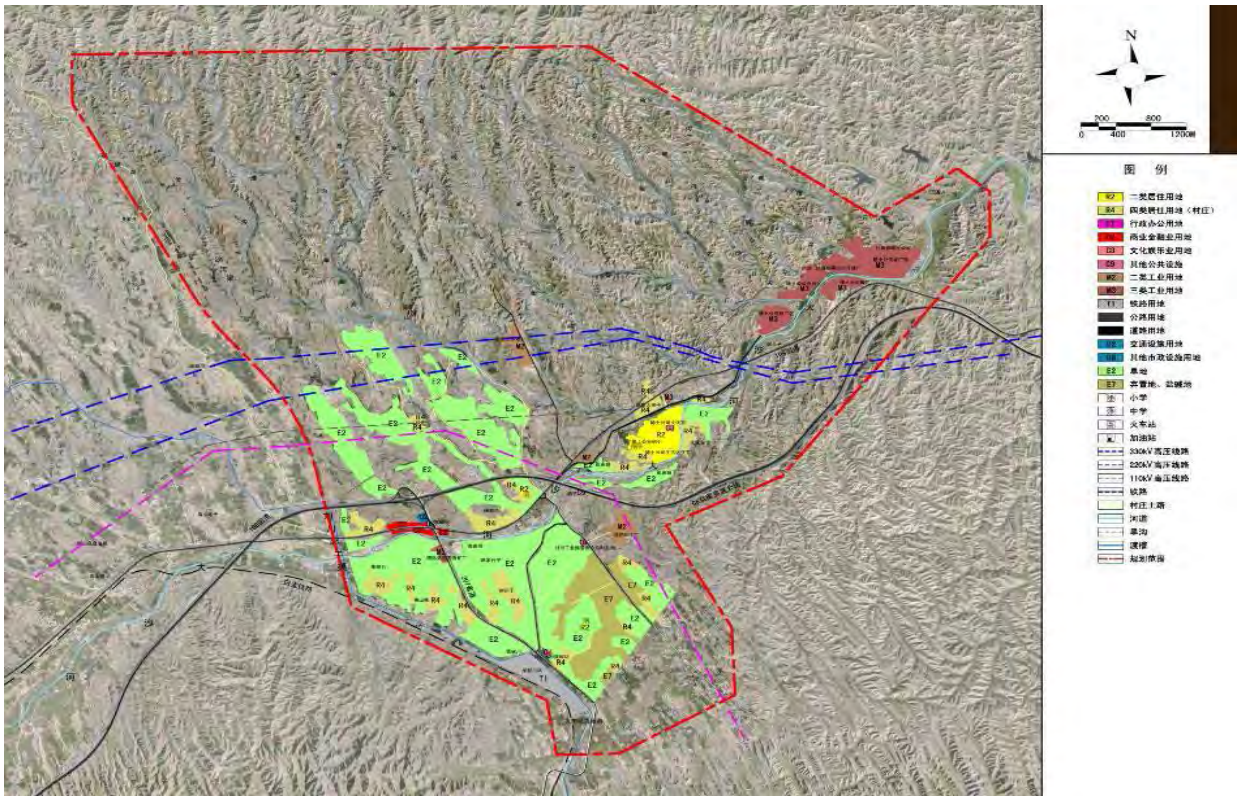


Figure 4: Existing Land Use on Project Site

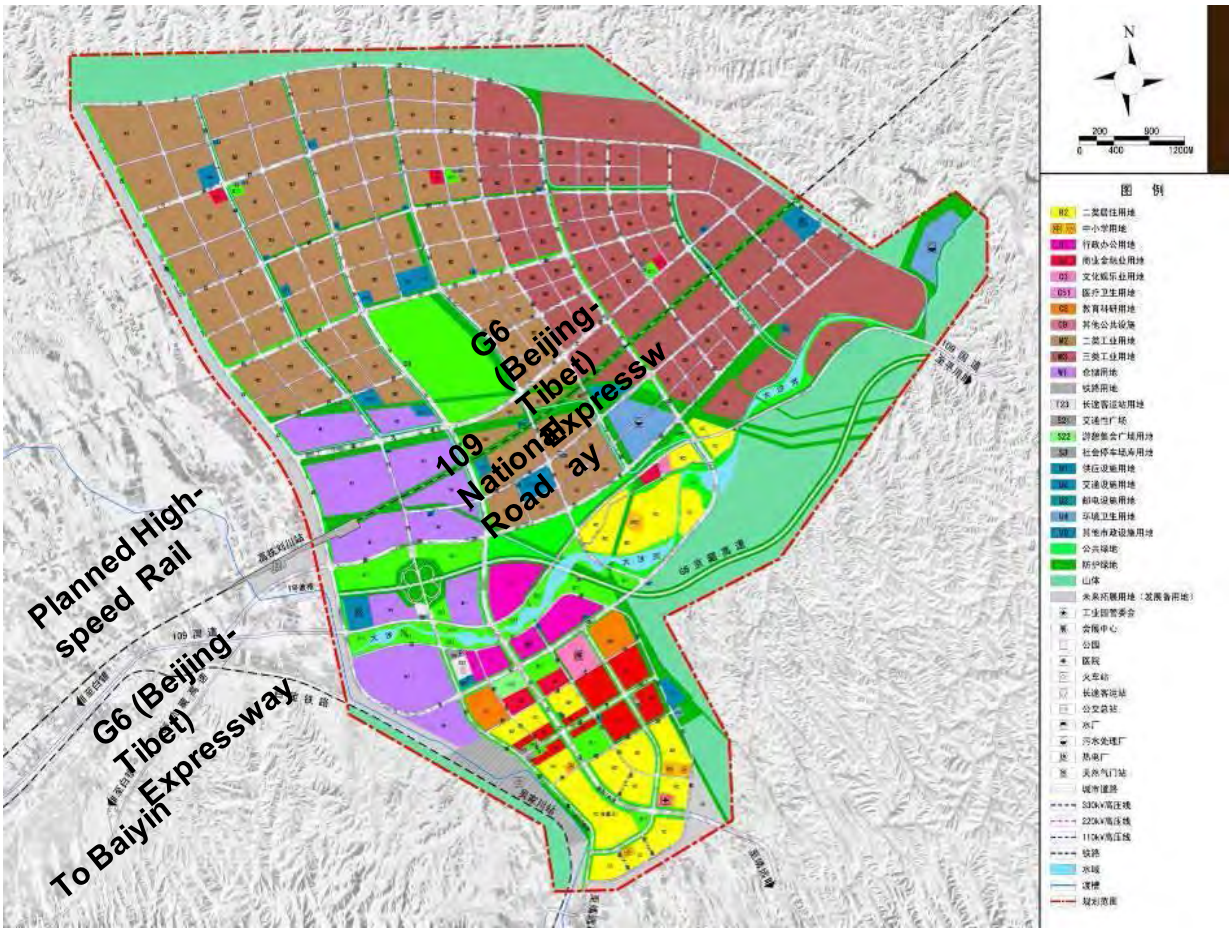


Figure 5: Land Use Plan for Industrial Park

11. In response to the development policy and strategy of Lanzhou-Baiyin Economic Integration, the industrial park will be developed along the trunk transport corridor of G6 Expressway. As one of the latest and largest industrial parks, LIP has the potential to become the new economic growth hotspot.

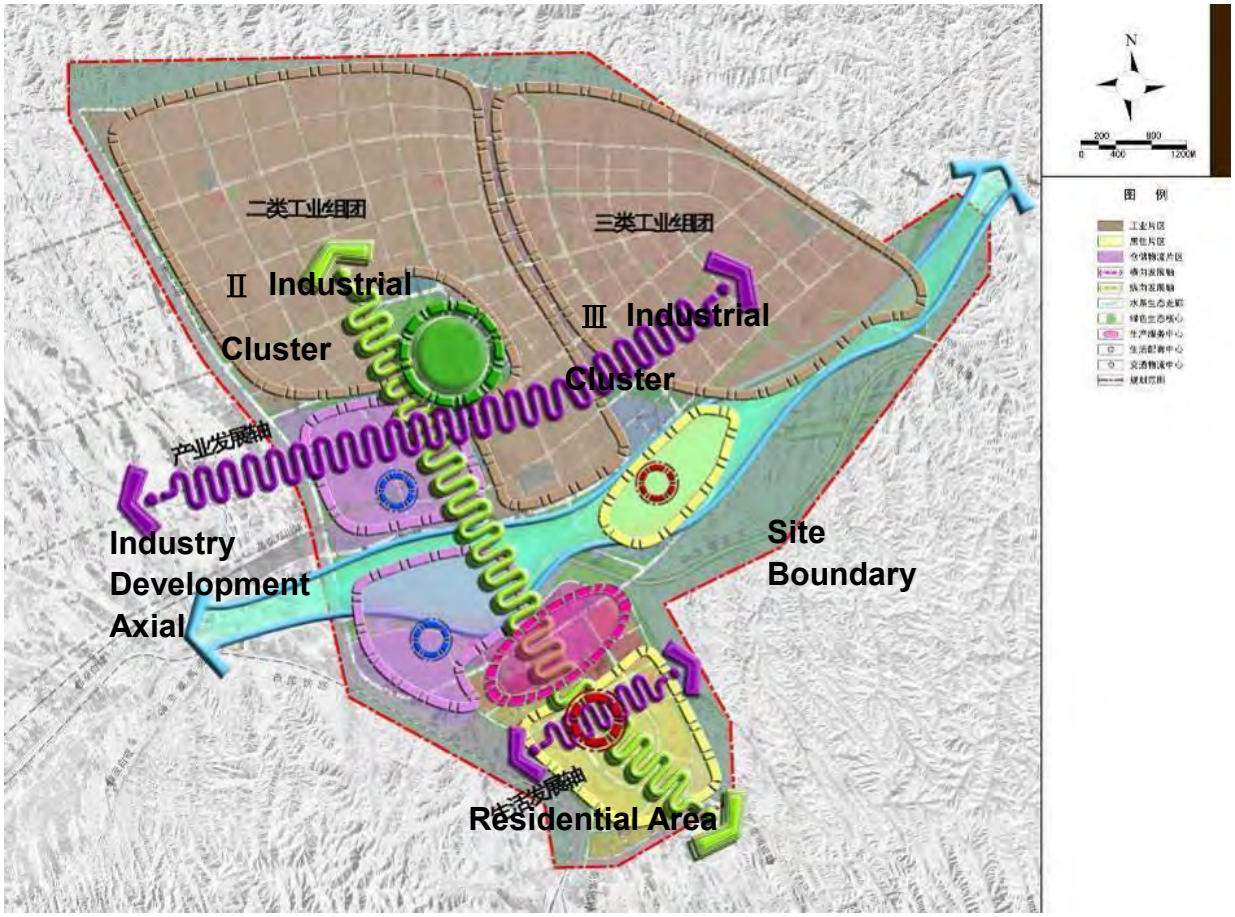


Figure 6: Major Development Zoning of Industrial Park

Land use Plan

12. The site is classified by six types of land use according to their functionality. Industrial and residential areas will occupy 42.85% and 31.06% of the land respectively. Transport will take up 19.92% of the land use.

13. The Master Plan envisaged 'one corridor, three axles, and seven sectors' for the industrial park development. 'One corridor' refers to the ecological strip along Dasha River at the south of the site. 'Three axles' refer to the two horizontal axles for industries and residents and one vertical axle linking these functional zones together. 'Seven sectors' are specified as two industrial zones, two warehousing and logistics centers and one public services center and two residential zones.

14. The river will maintain its function for flood control relief, and serve as a physical division between the industrial and residential areas. Public green space will be developed along the river to improve the living environment. The logistics zone will be developed around the expressway exit and railway station.

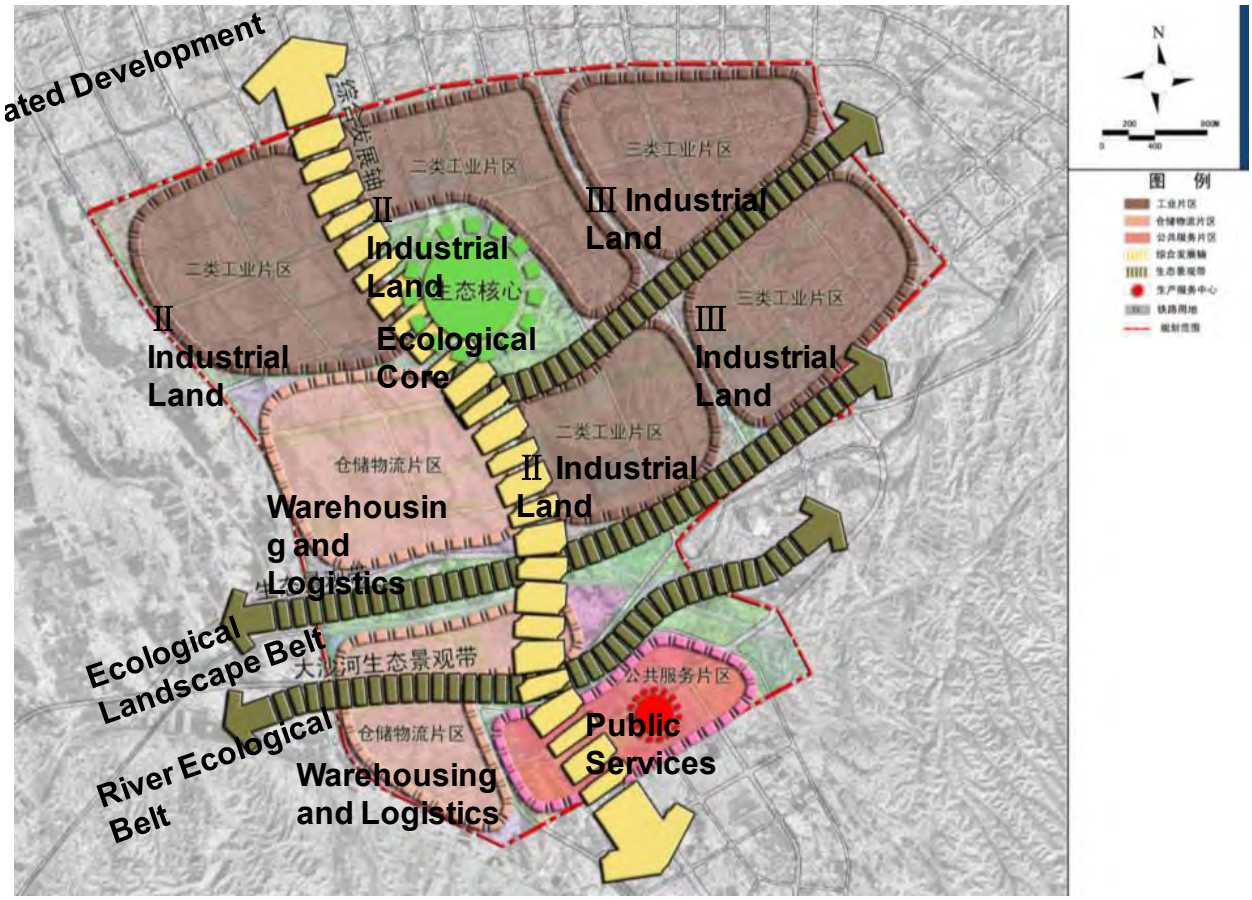


Figure 7: Development Strategy of One Corridor, Two Axles and Seven Sectors

Transport Conditions of Industrial Park

15. The industrial park is well-positioned along a trunk transport corridor. It is located 110 km from Lanzhou Municipality, the provincial capital, and 20 km from Baiyin City. It is 130 km away from Lanzhou Zhongchuan Airport. Existing highways and railway provide easy access for flows of people and goods in the region. The trunk transport lines are illustrated in the following diagram.

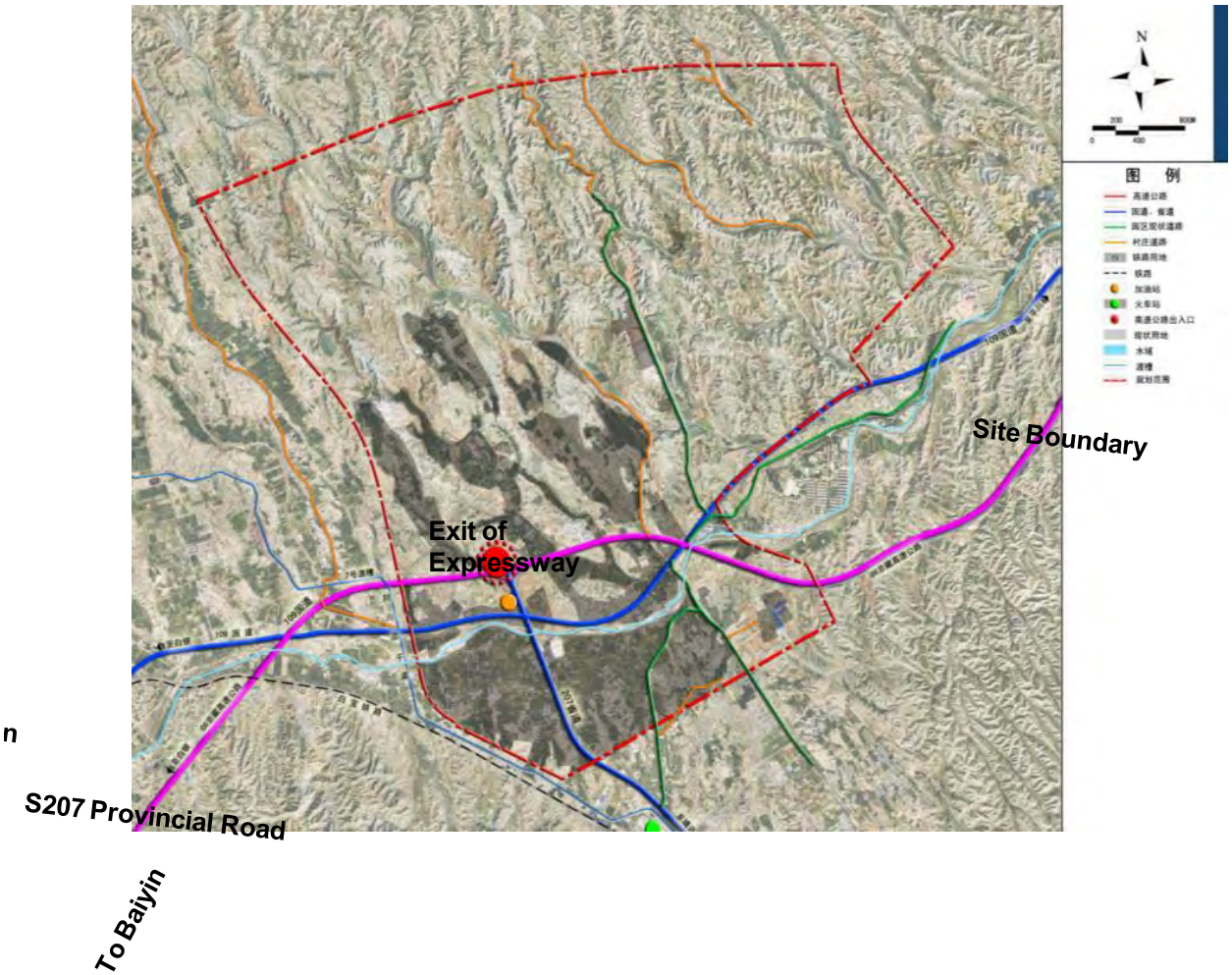


Figure 8: Existing transport conditions

Railway

16. Baiyin-Baojishan Railway (passenger and freight) bypasses the industrial park at the southwest. There is a station nearby at Wujiachuan. It is classified as Grade II national railway. A proposed high speed rail from Lanzhou to Baotou will pass through the industrial park. It will bring about a good opportunity to develop the industrial park into a logistic hub. The west part of the industrial park is planned for warehousing and logistics in coordination with the high-speed rail development.

Highway

17. G6 Expressway (Beijing-Tibet), a national trunk expressway, is aligned along the south of the project site. It is a dual 2-lane highway with right-of-way width of 68 m. It provides an entrance/exit at Qiangjiagou at the southwest end. Together with G109 National highway and S207 Provincial highway, it has formed a major link for local access. G109 is 42 m wide, Class II highway, linking Baiyin City to the west to Pingchuan District to the east. It currently takes a large share of traffic load. S207 highway is a north-south line connecting the expressway exit to Jingyuan County.

1.4 Liuchuan Industrial Park Detailed Plan (2010-2015)

18. The planned area for the industrial park accounts for 2,316.18 hectares. It covers an area east to the planned Jingwu Road, west to the planned Xihuan Road (project road) and south to

Nanshanwei Village (Xincheng North Road). The current site is barren and sparsely populated. Some village houses and factories are scattered on the site. Hills, basins, and gullies are naturally formed. The soil in most of the land is saline and alkaline. Some sandstone is exposed and weathered under wind and sun. There are some existing low-class roads and dirt tracks. A road network and other infrastructure have not been established.

Natural conditions

19. The industrial park is located on the loess plateau, at the middle and upper reaches of Yellow River. Vegetation is not developed thanks to dry climate and scarcity of water. The terrain tips from the northwest to the southeast. The elevation of the project site ranges from 1,467 m to 1,750 m. It is very hilly in the north, with elevation about 1,600 m to 1,750 m. Gentle hills dominate in the middle part, ranging from 1,467 m to 1,525 m; it reaches a low area in the south, where Dasha River flows from southwest to east.

20. There are around ten gullies naturally formed on the site. For the storm water, there is great extent of infiltration and evaporation. Surface runoff is directed through the gulley flowing into Dasha River. The river is intermittent and is dry most time of the year.

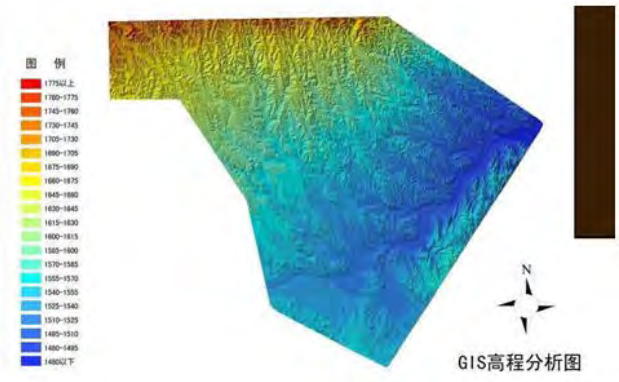


Figure 9: Site Elevation Analysis

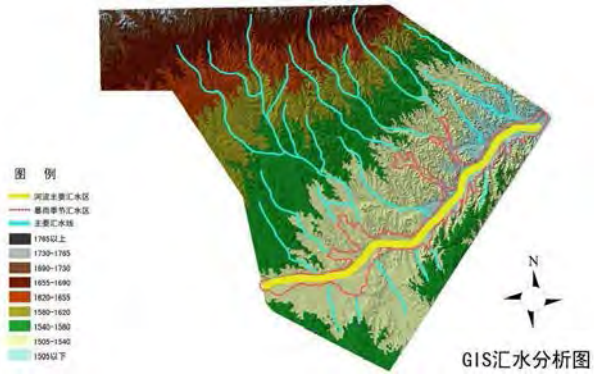


Figure 10: Catchment Analysis

Weather

21. The climate belongs to temperate continental arid climate. Annual rainfall amounts to 180 mm to 450 mm. Rainfall is scarce, and mostly concentrated in the months of July, August and December, which account for more than 60% of annual precipitation. The annual evaporation amounts to 1,500 to 1,600 mm, which is 4.5 times of precipitation. Spring is dry and sandstorm is prevalent from March to May. The wind speed is up to 12 m/s. Southeast wind dominates in summer and northwest wind dominates in winter. The annual average wind speed is 1.7 m/s, static wind frequency is 36%; annual average temperature 6~9^{o}C, extreme maximum temperature 36.3^{o}C, and extreme minimum temperature -22.1^{o}C. The frost-free period is 188 days. The maximum depth of permafrost is generally 93.8 cm and a maximum depth can reach 116 cm.

2. Road Subcomponent

22. The layout of the proposed road network is in a grid pattern. The road grid spacing is at approximately 600-800 m, which is greater than those of residential areas (usually about 400-500 m). Considering that the area is designated for industrial use, wider grid spacing is reasonable.

23. A total of 35 roads are proposed to form the industrial park road network. The road width ranges from 60 m for a trunk road to 20 m for a secondary/branch road. The proposed Xihuan

(west ring) Road under the ADB financed project is an urban trunk road designed as part of the road network of the industrial park. It will join Beihuan (north ring) Road, Nanhuan Road (south ring) and Xihuan to form a ring road circling around the industrial park. It is also part of "three vertical and one horizontal and one ring" of the overall trunk network, which are given priority for construction.

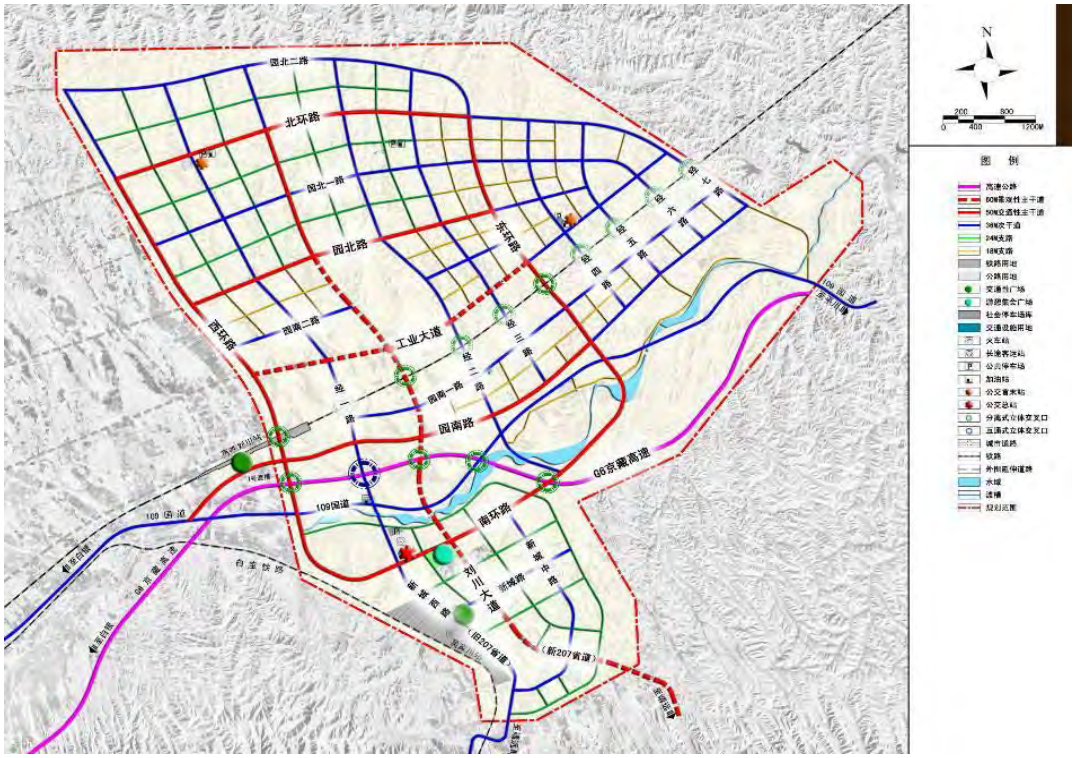


Figure 11: Proposed Road Component of Xihuan Road

2.1 Rationale

24. The industrial park and Lanzhou New District complement each other in development. It receives industries transferred from the Central and Eastern Regions, and constructs the province's key circular economy demonstration and regional logistics base, focusing on the development of rare earth, new materials and non-ferrous metal processing, equipment manufacturing, and industrial warehousing and logistics.

25. Baiyin Municipality is located within 'Lanzhou's one hour urban economic circle', which gives it opportunity for infrastructure and industrial upgrading, and strengthened market access. Jingyuan County, along with Baiyin, Dingxi, Linxia, Linzhao and Yongjing Counties, is within the 'one hour circle'. Given its local conditions and regional context, it has the potential to be developed into agriculture, chemical industry and energy bases. Industry sector reform is deepening and industry transformation is taking place.

26. With the eastwards urban expansion of Baiyin, the proposed road network is an important part of Baiyin East District to relief the increasing traffic load pressure. The road network is planned in line with related master plans and detailed plan requirements to meet the needs for freight transport and commuter accesses. The proposed Xihuan Road is part of "three vertical and one horizontal and one ring" of the overall network. It will form part of the ring road around the industrial park.

27. The site is currently weak in infrastructure. There is a lack of provision of drainage system. Wastewater is discharged randomly and brings negative impacts to the environment. Water supply is constraint, and locals have limited access of clean water. Only some low class roads and dirt tracks are available for local access. These have impeded future development of the

industrial park. Provisions of wastewater treatment, water supply and road infrastructure is in urgent need for the industrial park development. To achieve a balanced development, consideration has been given during the planning exercise for environmental protection and mutual benefits for locals and industrial growth.

2.2 Outputs

28. The function of Xihuan Road is as an urban road designed to urban Class II trunk road standard. The right of way width is 50 m with dual three motor-vehicle lanes. The design speed is 50 km/h. Utility services such as drainage and water supply, lighting and greening etc. will be provided along with the road construction. The outputs of the ADB financed project will provide the following infrastructure under the road subcomponent for LIP.

i) Xihuan Road: construction of 6.02 km road and associated utility services; ii) construction of 26 m long underpass beneath the G6 Expressway as part of Xihuan Road; iii) construction of 30 m long bridge overpass above Dasha River as part of Xihuan Road.

Table 1: Main features of Xihuan Road

	Class	Design speed (km/h)	Right of way width (m)	Length (km)	Land Acquisition (mu)
Xihuan Road	Trunk	50	50	6.02	320.4

Table 2: Main features of Structures

	Chainage	Span (m)	Width (m)	Angle α (°)	(m^2)	
Expressway Underpass	1+660	2×13	33	83	858	Box culverts
River Overpass	2+300	3x20	50	90	1,500	Simply supported-girder bridge

2.3 Traffic Demand Forecast

1) Background

29. The proposed LIP covers an area of approximately 23 sq km (short term) and for a longer term the area is about 50 sq km. The development will generate a significant level of additional traffic movement both internally within the development itself and to/from external areas. In assessing the potential impacts of these additional generated traffic movements it is important to understand their likely trip generation and distribution characteristics.

30. The development is predominantly employment based, with a supporting residential population and other amenities necessary for a development of this scale. The residential workers will be insufficient to match all the jobs, hence, external workers will migrate to the development.

31. Travel demand analysis was performed as part of the FSR making use of a travel demand model developed by the LDI on the basis of planning data derived for different planning horizons for the industrial park. The base year model was calibrated and validated based on locally collected traffic and economic data.

32. Owning to the tight project schedule, insufficiency of local data and limited technical capacity of local staff, it is not possible to develop a complex and comprehensive travel demand model for use in this project. A simplified travel demand model was adopted with basic information and additional locally collected traffic volume data. The base year matrices were derived based on the matrix estimation techniques and validated with existing traffic counts.

Gravity trip distribution model was performed to estimate the projected travel pattern. The traffic assignment for the various planning horizons was performed by using the modeling software TransCAD.

33. In the development of the existing O-D matrix of hourly car-traffic volumes, no origin-destination (O-D) trip survey was carried out. Instead, traffic counts were surveyed on major highways. Inverted OD modeling is applied to calibrate the existing O-D matrix based on the motorized traffic counting during peak-hour period.

34. The construction of the road network was commenced in April 2012. The sub-grade of 10 roads is currently under construction. Road construction has been phased and trunk roads will be given top priority. Liuchuan Avenue and Gongye Avenue as the backbone in the network form the first batch under construction. In conjunction with the progress of land development, the number of minor roads in the network will be reduced. Given the features of the industrial park, large bulk of land would be acquired for each single factory development. Some minor roads would appear redundant.

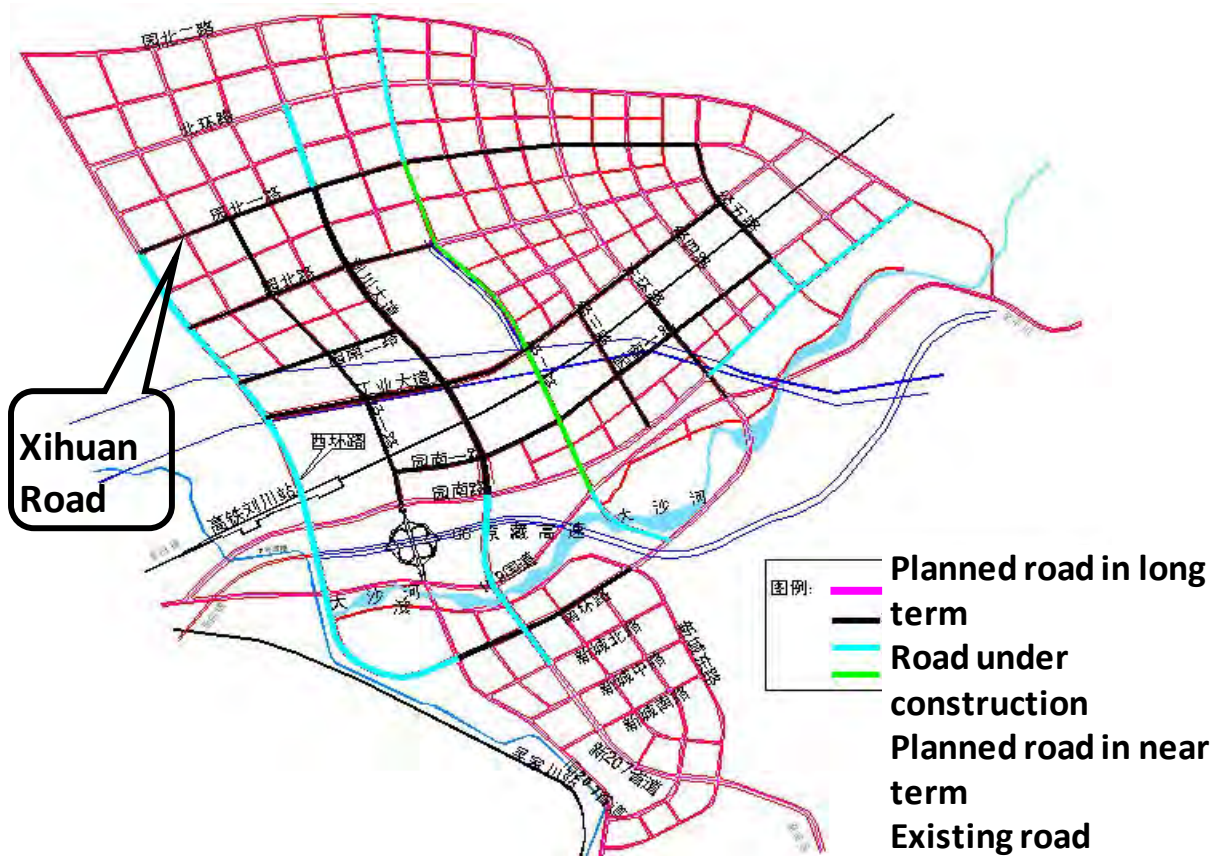


Figure 12: Planned Road Network (23 sq km)

35. It is noted that the industrial park would be further expanded towards the west covering 50 sq km in the longer term. But the planning concept is still under discussion and no concrete plan is available. The LMC has prepared a preliminary road network plan layout as shown below Figure 13.

Figure 13: Planned Road Network (50 sq km)

2) Traffic Surveys:

36. Traffic counts were carried out on 19 December 2013 at selected road segments during the evening peak hour from 17:30 pm to 19:30 pm. Five counts were selected along Highway G109, G6 and S207 as shown in Figure 14.

Figure 14: Location of Traffic Counts

37. These counts provide the basic dataset for the validation and adjustment of the travel demand model. The surveys covered the major road segments in the vicinity of the industrial park, as well as road segments representing external highways. Survey results are presented in Table 3 below.

Table 3: Peak Hour Traffic Count (pcu/h)

Traffic Count	Car	Mini-Van	Bus	Small truck	Medium truck	HGV	Truck with Trailer	Other	Sum (pcu/h)
1. G109 national road (to Lanzhou Direction)	50	16	11	22	26	17	9	55	266
2. National Road G109 (to Yinchuan Direction)	42	13	10	19	23	14	7	46	227
3. Provincial Road S207 (to Jingyuan direction)	47	12	9	14	18	9	6	59	203
4. Provincial Road S207 (to Baiyin direction)	36	9	6	11	13	7	5	45	153
5. Beijing to Tibet Expressway G6 (Wujiachuan Exit)	41	9	8	17	9	7	6	0	141

HGV: Heavy Goods Vehicle; PCU: Passenger Car Unit

3) Assessment process

6. It is stated in the FSR that the model used is a typical ‘trip-based’ four-stage travel demand forecast model, which consists of trip generation, trip distribution, modal split and assignment

models. The general description of each of the sub-models are as below:

- Trip generation: estimating the number of trips generated from and attracted to each traffic zone;
- Trip distribution: estimating the number of trips travelling between each origin and destination pair, in the form of trip tables;
- Modal split: splitting the trip tables into tables of different travel modes;
- Traffic assignment: assigning the trip tables of various travel modes onto the roadway network to estimate the traffic volumes on the networks.

7. Based on the traffic counts, a base year OD matrix is generated. In consideration of the increase of population, car ownership, and car utilization rate, the projected traffic volumes at each road are generated for modeling purpose.

4) Projection on employment and residents

8. The Master Plan estimates the population for the LIP of approximately 34,000 persons by 2020 and 68,000 persons by 2030. Following the interim mission of this PPTA, a thorough population forecast under the section of industrial demand analysis guided by priority industries was carried out. The analysis results for the estimated population size of the LIP is between 36,000 and 39,000 in 2020, between 73,000 and 79,000 in 2030 and about 90,000-98,000 in 2033 at full development – during the night time or daytime. The traffic demand forecast team made its own population projection in line with the principles. Though a simple analysis is undertaken and the population figures appear on the low side, the results are considered to be within a reasonable range. Details are presented in the subsequent sections.

9. The number of trips for each of the land-use components proposed for the industrial park has been estimated based on the Gross Floor Area (GFA), which is converted to number of jobs, residents, school children and workers. There are three sources for employment: workers from Baiyin City and other counties; workers from nearby villages; and migrants from other areas.

10. The development will generate jobs at the production areas and office, as well as supporting amenities. Assuming an average of 250 square meters of production area per job, and 1,000 square meters of logistics area per job, there will be 83,916 jobs created from the industries. The ratio of employment for production/supporting service is assumed at 10/1. Hence, in total 92,308 employees of the development will work in an area of 24,107,250 square meters of GFA by 2013 as shown in the Table below.

Table 4: Assumptions on Employment

Employment type		GFA/job (m^2)	Jobs
Production area	Industries	250	79,745
	Logistics	1,000	4,171
Supporting services (one for every ten production jobs)			8,392
Total			92,308

11. For a development of this scale it is not expected that all resident workers will be employed. In order to create the worst case design conditions, 50% of the employees are assumed to reside in the industrial park. The rest would commute to/from Jingyuan County, Baiyin City or other area. In total 45,000 workers will live in the residential area within the industrial park. Considering that a typical family includes a working couple and a child, it is expected that a population of 67,500 will live in the development, in mainly residential units, with some mixed use contributing to the overall population. The household size is expected to be quite low with some single person units, which is typical for such industrial park developments.

Table 5: Assumptions on residents in the development area

	Residents
Residential workers	45,000
Total population within the development (assuming three members in one household, of which two are employed)	67,500

5) Traffic Zoning

12. The traffic demand model is based on the Industrial Park Detailed Plan's planning vision of the 'industrial zones'. Based on the sector development plan, thirteen traffic zones are identified for the 23 sq km with ten within the industrial park and three peripheral impact zones, which are numbered continuously from those of the industrial park. The area is developed along the trunk transport corridor and the development of the new industries is currently ongoing. It is noted that the industrial park will accommodate industries like rare earth, aluminum, rare earth, coal chemical, equipment manufacture, ceramics, power plant etc. 70% of enterprises have currently been settled in or signed contracts with the LMC.

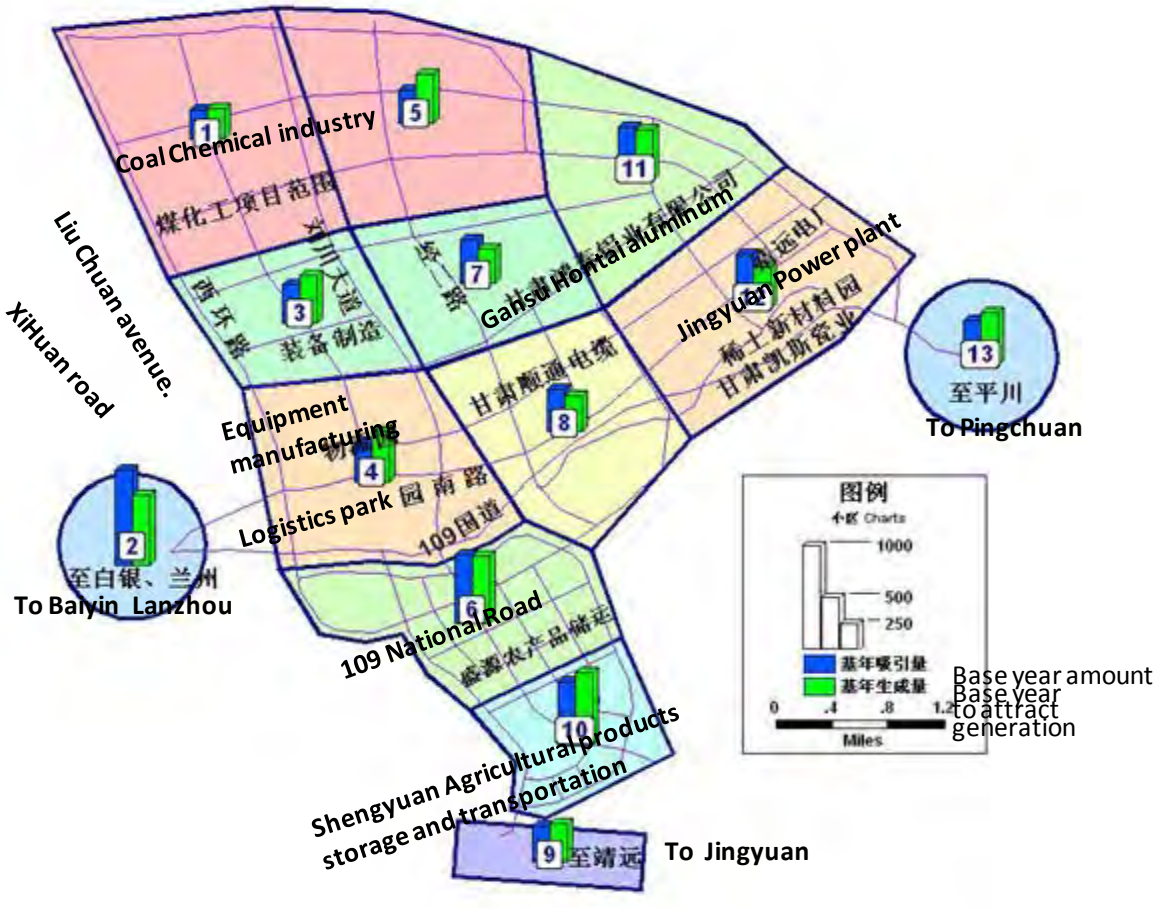


Figure 14: Diagram of the major 'traffic zones' for 23 sq km in 2034

13. Following the interim mission of this PPTA, the demand forecast analysis was expanded for the 50 sq km of the long term plan. As presented in the figure below, 17 traffic zones are further identified and analyzed. Zones 2, 13, and 17 of Baiyin, Jingyuan County center and Pingchuan District are considered as primary external zones.

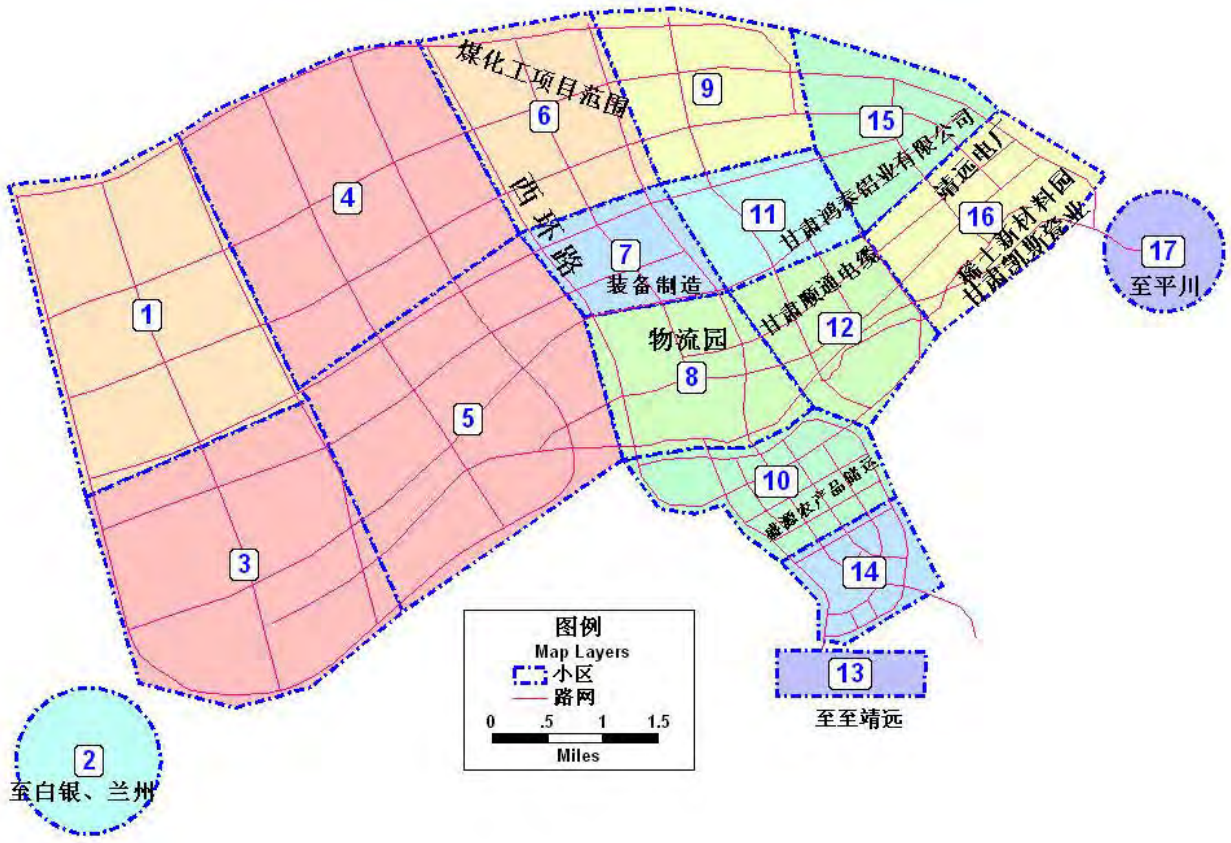


Figure 15: Diagram of the major 'traffic zones' for 50 sq km in 2034

6) Traffic growth projection

14. Traffic growth should be based on the regression established between gross domestic product (GDP) and total number of motor vehicle (MV) trips. The growth rates derived from the transport model for the different planning horizons are tabulated for reference.

Table 6:Traffic Growth Projection

Year	2015-2019	2020-2024	2025-2029	2030-2034
Traffic Growth rate	8.4%	7.1%	4.9%	3.1 %

7) Modal split

15. According to the surveys made to urban residents among cities in the PRC and other countries, the number of personal trips daily made ranges from 2.0 to 3.5. For this project, the daily trip for the planning horizon of 2030 is estimated at 2.1 per person, which demonstrate the characteristics of the industrial area. In the LIP, the daily trip pattern would show distinguished morning, noon and evening peaks. The travel characteristics indicate the morning peak time appears at 7:30 – 8:30; the noon peak at 12:00 – 13:00 and the evening peak at 18:00 – 19:00.

16. The average modal share of the different modes of transport was derived from the local transport model. The estimates take into consideration the automobile fleet size, travel time and time cost of different travel modes. A simplified modal split adopted for 2030 is tabulated below.

Table 7: Assumption on trip modal split

Walk	NMT	Bus	Car	Other
29%	18%	36%	11%	6%

8) Traffic distribution

17. In this simplified transport model, the study area was defined in seventeen traffic zones in accordance with the detailed plan. The vehicular trip matrices were developed based on the defined modal share and trip generation and distribution models. The vehicular matrices were assigned onto the road network such that the predicted traffic volumes on the project roads can be obtained. Figure 15 indicates the daily desire line diagram of each of the zone pairs.

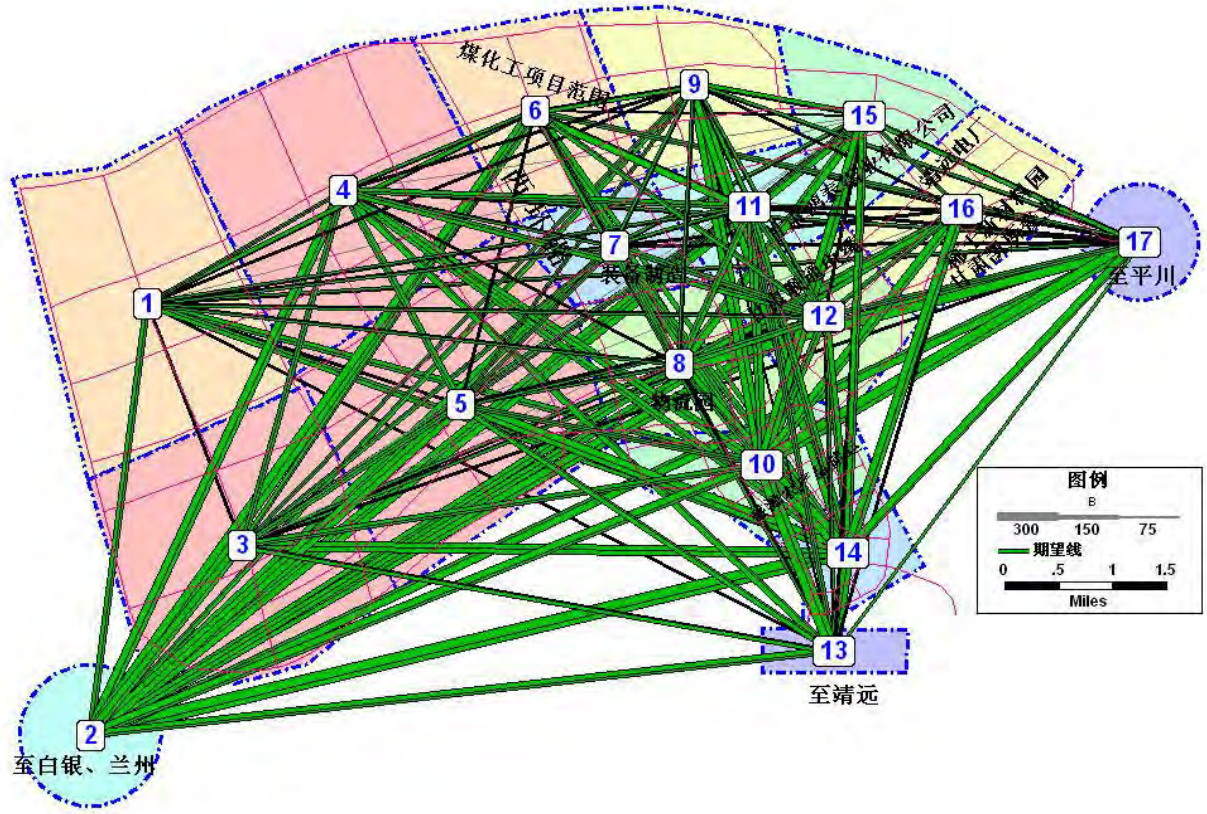


Figure 15: Desire Line Diagram of Projected Daily Trips (2034)

9) External traffic forecast

18. Given the location of the industrial park, external trip destinations are mainly of Baiyin and Lanzhou City, Jingyuan County and Pingchuan District as defined as zones 2, 13, and 17 respectively. According to the Statistics Yearbook of Baiyin in 2012, the population of Baiyin District was 276,542; that of Pingchuan District was 200,769; and that of Jingyuan County center was around 100,000. Population data for 2013 cannot be obtained. During trip distribution, external trips are separated from internal trips. Total trip generation and attraction for different planning horizons are presented in table below.

Table 8: External Trip Generation and Attraction

Year	To Baiyin, Lanzhou		To Jingyuan		To Pingchuan	
	Generation	Attraction	Generation	Attraction	Generation	Attraction
2015	1,051	1,219	448	599	585	609
2019	1,440	1,671	614	822	802	835
2024	2,010	2,333	857	1,147	1,120	1,166
2029	2,541	2,950	1,084	1,450	1,416	1,473
2034	2,960	3,436	1,262	1,689	1,649	1,716

10) Freight traffic projection

19. Traffic demand for the proposed road is forecasted by vehicle types, and further divided by their trip purposes. In consideration of the traffic counts and modes of other similar industrial parks, the trend of development can be projected. It is assumed the ratio of freight to passenger traffic will be 56% to 44%.

Table 9: Demand forecast by vehicle type

	Passenger			Freight				Total	(pcu/h)
	Car	Mini-Van	Bus	Small truck	Medium truck	HGV	Trailer		
2015	255	77	69	207	100	69	38	815	1,152
2019	396	120	109	327	157	109	60	1,278	1,809
2024	551	167	150	450	217	150	83	1,768	2,501
2029	666	201	181	544	262	181	101	2,136	3,022
2034	793	240	216	651	312	216	120	2,548	3,604

HGV = heavy goods vehicle

11) Traffic assignment

20. After the trip distribution, traffic flow will be assigned to future road network in the project area. The figure presents flow volumes in bandwidth, but flow volumes have yet to be provided.

21. Following the interim mission of the PPTA, the draft analysis has been improved and the scenario "build" or "no build" has been developed to show the effect with or without the proposed road. But link data in various planning horizons still have not been supplemented.

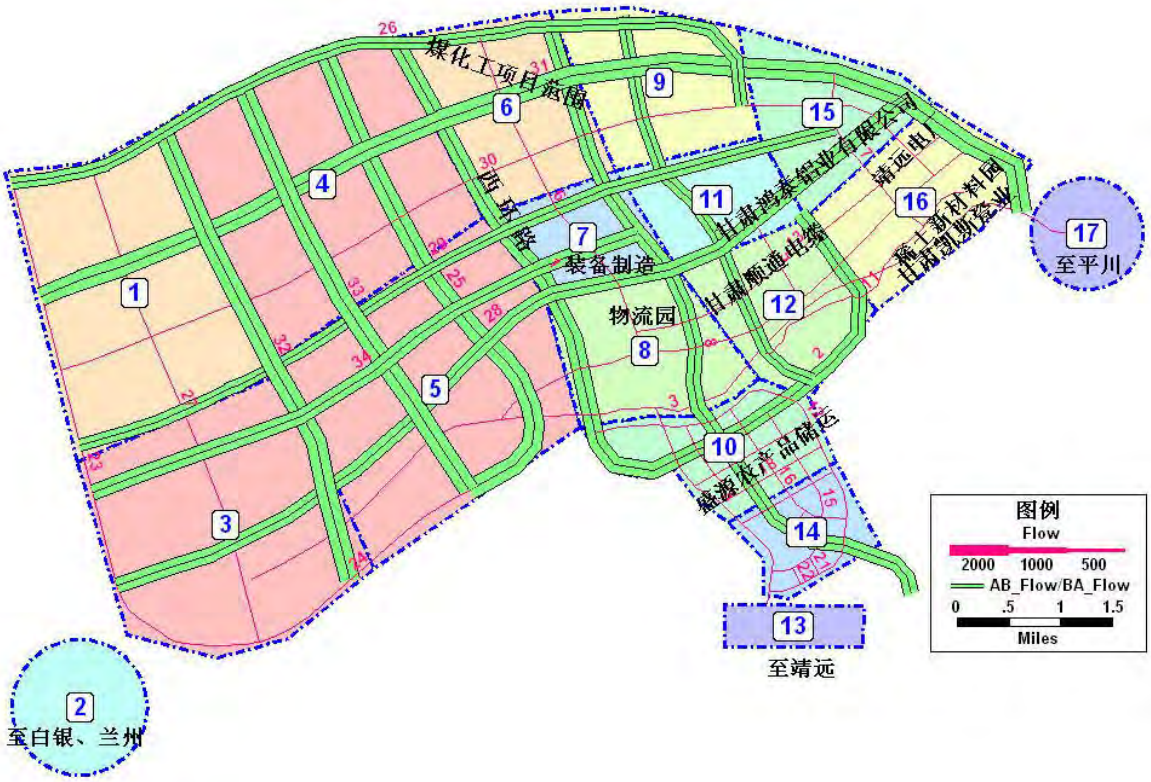


Figure 16: Traffic Loading on Future Road Network 'Build'

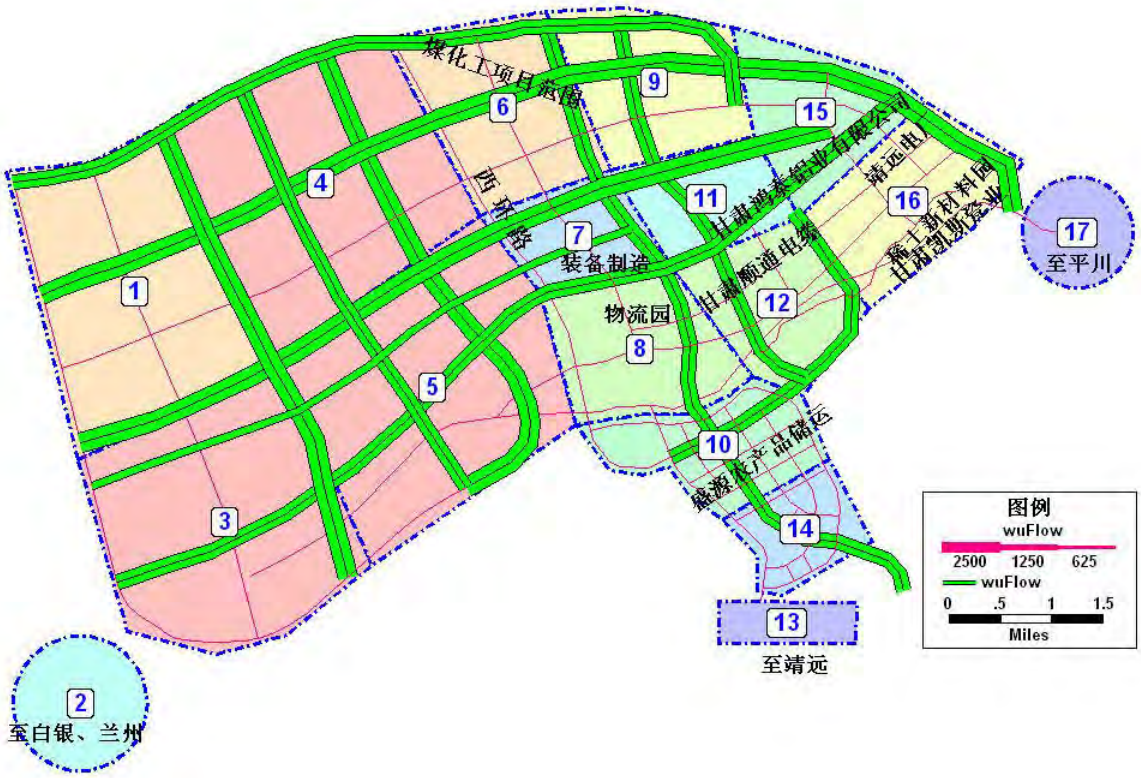


Figure 16: Traffic Loading on Future Road Network 'no build'

22. Table 9 below shows the assigned traffic to the proposed road section for various planning horizons.

Table 10: Assigned traffic in various planning horizons

	2015	2019	2024	2029	2034
Xihuan Road	1,048	1,646	2,276	2,750	3,280

23. The capacity of each type of roads and bridges was adjusted by factors of lane width, number of lanes, distance between intersections, and traffic mix. The adjusted capacities are presented in the Table 10 below.

Table 11: Road and Bridge Capacity by Classes

Type	f1	f2	f3	f4	f5	f6	One-way Capacity (pcu/h)
Dual-3 lane urban trunk road	1	1	2.7	0.67	1	0.9	2,198
Dual 3 lane road bridge	1	1	2.7	0.68	1	0.91	2,256
Dual-2 lane urban secondary road	1	1	1.9	0.62	1	0.85	1,302
Dual-2 lane urban road bridge	1	1	1.9	0.63	1	0.86	1,338

Correction factor f1 – width of lane

Correction factor f2 – distance to road side curb

Correction factor f3 – number of lanes

Correction factor f4 – intersection

Correction factor f5 – MV and NMV mixed traffic

Correction factor f6 – level of utilization

24. According to the Urban Road Design Specifications, CJJ37-1990, the capacity for one motor vehicle (MV) lane at a speed of 50 km/h, with intersection adjustment, is 1,352 passenger car units per hour (pcu/h). Based on the adjusted carriageway capacity and the projected flows for 2030, the proposed Xihuan Road can be justified as a dual 3-lane road. The following table shows the projected two-way traffic volumes on the proposed road and the degree of saturation in terms of Volume and Capacity Ratio (V/C).

Table 12: Traffic Forecast Results, Unit: pcu/h

Road section	2015		2019		2024		2029		2034	
	2-way flow	V/C	2-way flow	V/C	2-way flow	V/C	2-way flow	V/C	2-way flow	V/C
Xihuan Road	1,152	0.25	1,809	0.40	2,501	0.55	3,022	0.66	3,604	0.79

25. The above traffic projections are based on the updated traffic assignment reported from the December-2013 version of the FSR. The focus was on the additional attraction induced by the provision of the proposed roads. The addition traffic attracted to the system over the period from 2015 to 2034 is in the range of 20 to 70 pcu/h in one direction. The above assessment of the road configuration proves that there will be sufficient link capacity for carrying the projected traffic.

26. Several side roads are connected to the proposed project roads. The following table lists the relevant road sections and their current status. These roads will link up with the major existing roads, such as G109 and XS207, which are carrying relatively heavy traffic at present.

Table 13: Roads Bisecting the Project Road

	Road bisected	Chainage	Cross section	Type of intersection
1	Xicheng West Road	K0+000	6+24+6=36 m	At-grade
2	South Binhe Road	K1+594.55	5+14+5=24 m	At-grade
3	G109 National Road	K1+885.259	10.5 m (existing) 6+24+6=36 m (plan)	At-grade
4	G6 Expressway	K2+300	25 m	Grade-separation
5	Yuannan Road	K2+620.348	6+5+2+24+5+2+6=50 m	At-grade
6	High speed rail Station	K2+930	75~80 m	Grade-separation
7	Gongye Road	K3+856.688	6+5+3+12+8+12+5+3+6=60 m	At-grade
8	Yuannan Second Road	K4+315.661	6+24+6=36 m	At-grade
9	Planned Road	K4+651.382	3+12+3=18 m	At-grade
10	Yuanbei Road	K5+078.636	6+5+2+24+5+2+6=50 m	At-grade
11	Planned Road	K5+524.876	5+14+5=24 m	At-grade
12	Yuanbei First Road	K6+021.994	6+24+6=36 m	At-grade

12) Key issues

27. Following the interim mission of the PPTA, the TA Consultants have held discussions with the DI on how to improve the demand forecast analysis. Key issues have been addressed and drafts were improved. However, given the constraints of limited resources and local data, some issues still remain to be tackled as shown below.

28. The projection of future traffic demands is based on projected land use data and the growth rates derived from the GDP growths. The demographic and economic projections for future years have been presented in other chapters of PPTA report. Population projection is vital for the demand analysis. The industrial sector specialist undertook a detailed and credible analysis in conjunction with industrial demand analysis. The work will not be duplicated under the road technical assessment.

29. The TA Consultants requested for the information for transit development to be supplemented. However, at the early stage of LIP development, a public transport plan is unavailable. It is noted that currently there are long-distance bus routes linking Baiyin with Jingyuan County having a stop at LIP. Along with the industrial development, public transport should be given priority for commuting and policy preferences should be considered on how to encourage people to take public transport.

30. Freight traffic forecast has been separated from passenger demand forecasts based on an assumed ratio. But this appears over-simplified. Assumptions on modal split in terms of percentage of trips by walking, car, bicycle and bus are missing. It is recommended that other similar industrial parks in terms of demography, employment and trip patterns be investigated, to make assumptions for internal/external trips and modal split.

31. Traffic count survey was carried out on major external highways during the evening peak hour. However, highways do not have distinctive morning and evening peaks. A twelve hour survey 7:00 (AM) to 7:00 (PM) is recommended to better reflect the real traffic flow situation. But due to lack of capacity and means, a supplementary survey has not been conducted.

32. In the absence of detailed traffic counts and OD survey, OD validation was adopted to estimate the total number of trips generated and attracted. External trips have been separated

from internal trips. Ideally, external trips can be forecasted by using Fratar (growth rate method). Internal trips forecast will need to follow the four-stage method.

33. To illustrate the necessity of the project, a 'no build' case has been examined. The 2034 traffic flows have been assigned onto the road networks for the cases "build" and "no build". But link data in the form of bandwidths and flow volumes in each traffic direction have not been presented.

2.4 Classification and Technical standards

34. Key characteristics of technical standards are presented below and design parameters are selected in line with relevant national codes and design specifications.

Table 14: Major Design Parameters

	Unit	Xihuan Road
Class		Urban Trunk
Design traffic load capacity	pcu/h	4,410
Peak hour traffic flow in future year	pcu/h	3,122
Design speed	km/h	50
Length	m	6,022
Cross-section	m	6 + 5 + 2 + 24 + 2 + 5 + 6 = 50 m
Pavement Design Load		BZZ-100
Minimum horizontal curve radius	m	—
Maximum vertical slope gradient	%	3.26
Minimum vertical slope gradient	%	0.31
Pavement		Asphalt Concrete
Rainfall Return Period	Year	1
Bridge and Culvert		Urban – A Grade
Seismic fortification intensity	^{o}C	8
Lighting Standard		Average Illumination: 28 Lux, Pavement Average illumination: 1.75 cd/m^2, Brightness uniformity: 0.4
Design Year		Design life for traffic reach saturation: 20 years, Pavement design life: 15 years

2.5 Public Transport

35. There is no public transport plan available. Currently, the long distance bus route from Jingyuan County to Baiyin has a stop at the industrial park. In the FSR, bus bay provisions have been considered and incorporated in the design. Given the travel pattern of the industrial park, shuttle buses are vital for the commuters to travel among work and residential area, and shopping, school etc. It is recommended to establish bus priority within the park at the right time in the future.

2.6 Design Analysis

1) Horizontal Alignment

36. Total length of the road section is 6,010 m. For the horizontal layout, 4 turning points are set up, with a minimum radius curve of 500 m. The proposed road will intersect the existing G109, and the underpass G6 highway at k2+300 in the form of a box culvert, and cross Dasha River at k1+660 in the form of a simply-supported girder bridge.

2) Vertical Alignment

37. The vertical alignment is designed to meet the urban road design specifications and related flood control and drainage requirements. The minimum longitudinal gradient is 0.31% to satisfy the drainage requirements. The maximum longitudinal gradient is 3.26%; while a 2% cross fall of the pavement is for storm water runoff. The vertical alignment will need to be elaborated after obtaining the results of more detailed topographic survey, so that it will follow the landform as much as possible to minimize earthworks.

38. Earthwork. Initial assessment indicates that earthwork cut and fill will be moderate compared with other similar road projects in the area. Lessons learnt from Baiyin Phase I ADB project for the industrial area, for which earthwork quantities were significant, is that careful site investigations should be made during the next stage of the preliminary design to better understand the site conditions and avoid design variations during implementation.

3) Road Cross Section

39. The selection of the road cross section is based on the road classification and the volume of traffic. The proposed road is a dual 3-lane 24 m wide carriageway and with provision of non-motorized vehicle lanes and sidewalk. Alternative analysis has been carried out to optimize lane configurations. For option one, the overall right of way width is 50 m which is made up of 6 m sidewalk + 5 m non-motorized vehicle lane (NMV) + 2 m divider + 24 m carriageway (two-way) + 2 m divider + 5 m NMV + 6 m sidewalk.

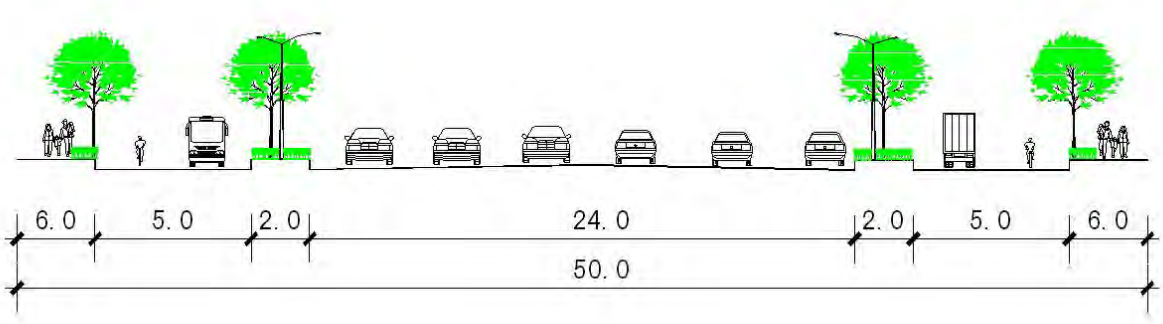


Figure 17: Option One – Cross section of Xihuan Road (Alternative)

40. For option two, the overall right of way width is 50 m, which is made up of 5 m sidewalk + 5 m NMV + 2 m divider + 12 m carriageway (one-way) + 2 m median divider +12 m carriageway (one-way) + 2 m divider + 5 m NMV + 5 m sidewalk.

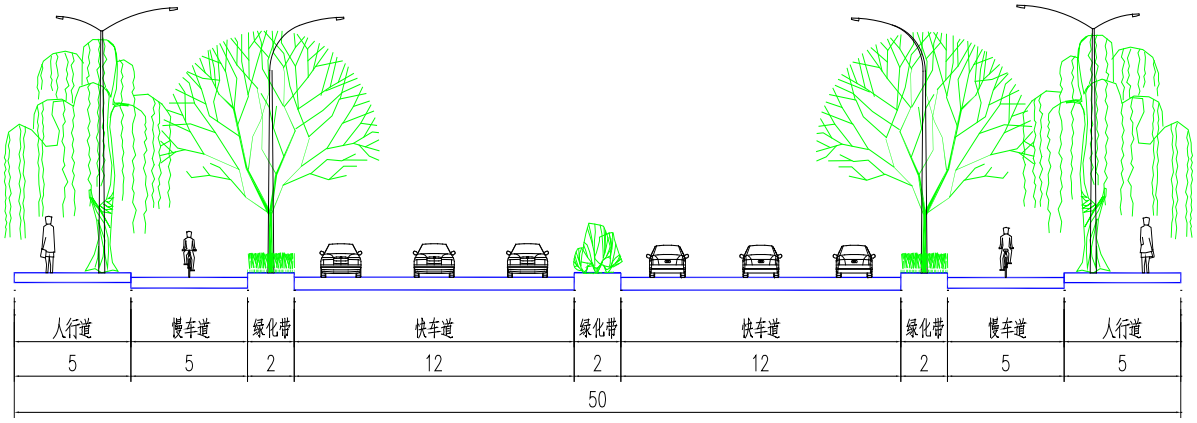


Figure 18: Option Two – Cross section of Xihuan Road (Recommended)

41. During the interim mission, Option one was recommended for the reason that it would save space and investment. However, following ADB mission's request, after consideration of road safety, a median separation may provide space for refuge for pedestrians crossing and a safer driving condition for both directions. Given the projected relatively low traffic flow, the lane configuration of Option Two is considered more adequate.

4) Sub-grade and Protection Works

42. The design was carried out with reference to geological surveys for roads within the same area. The total earthwork volume will be moderate for the proposed road. Substantial cutting will be present at the north section of the road. Earthworks fill and cut balance has been considered during the vertical alignment design.

43. Simple slope protection measures are proposed in the FSR. It is noted that overall site formation will be undertaken in parallel with the road construction. Hence, temporary measures will be taken to stabilize the sub-grade slope. Slope stabilization will be realized by compaction and vegetation, in coordination with overall site formation.

5) Pavement

44. Due to local deep frost soil, thicker sand and gravel base courses are adopted to prevent thermal frosting. A comparison was made between cement concrete and asphalt concrete surface pavement. Asphalt concrete pavement was recommended because it is relatively easy to be applied and repaired. In addition, it will be more appropriate for use in the local weather condition and to a certain extent it reduces road traffic noise in comparison with rigid concrete pavement. Table 15 shows the proposed pavement structure for the main carriageway and the NMV lane, and sidewalks. The proposed pavement structure designs are adequate in meeting the projected traffic loading. Particular attention needs to be drawn to account for the low temperatures in Baiyin to avoid pavement surface cracking.

Table 15: Proposed Road Pavement for Carriageway and NMV Lane

Pavement Type	Structure	Thickness (cm)	Remarks
Carriageway	Medium-graded asphalt concrete (AC-16)	5	Spread tack coat oil
	Coarse-graded asphalt concrete (AC-25C)	7	Spread tack coat oil
	5% cement stabilized sand and gravel	20	Spread prime coat oil
	Cement and lime stabilized sand and gravel	30	
	Total	62	
NMV Lane	Fine-graded asphalt concrete (AC-13C)	4	Spread tack coat oil
	Medium-graded asphalt concrete (AC-20C)	6	Spread prime coat oil
	5% cement stabilized sand and gravel	20	
	Cement and lime stabilized sand and gravel	20	
	Total	50	
Sidewalk	Sidewalk Tile	6	
	C20 cement concrete	10	
	5% cement stabilized sand and gravel	15	
	Total	31	

Abbreviations: NMV = non-motorized vehicle

6) Intersection Treatment

45. For all the road sections except where G6 expressway and G109 will be bisected, at-grade intersections are proposed in consideration of the function of roads serving all road users and to ensure easy access for pedestrians and cyclists. Signalization will be provided when a primary road intersects another primary/secondary road. The typical intersection design has been provided as presented in the figure below. Pedestrians crossing at intersections are relatively well designed for with signals for pedestrians and bicycles. However, road safety elements, e.g. intersection channelization, safe pedestrians crossing and refugee islands, mid-block crossing, and pedestrian signals should be further developed during the next step of preliminary design.

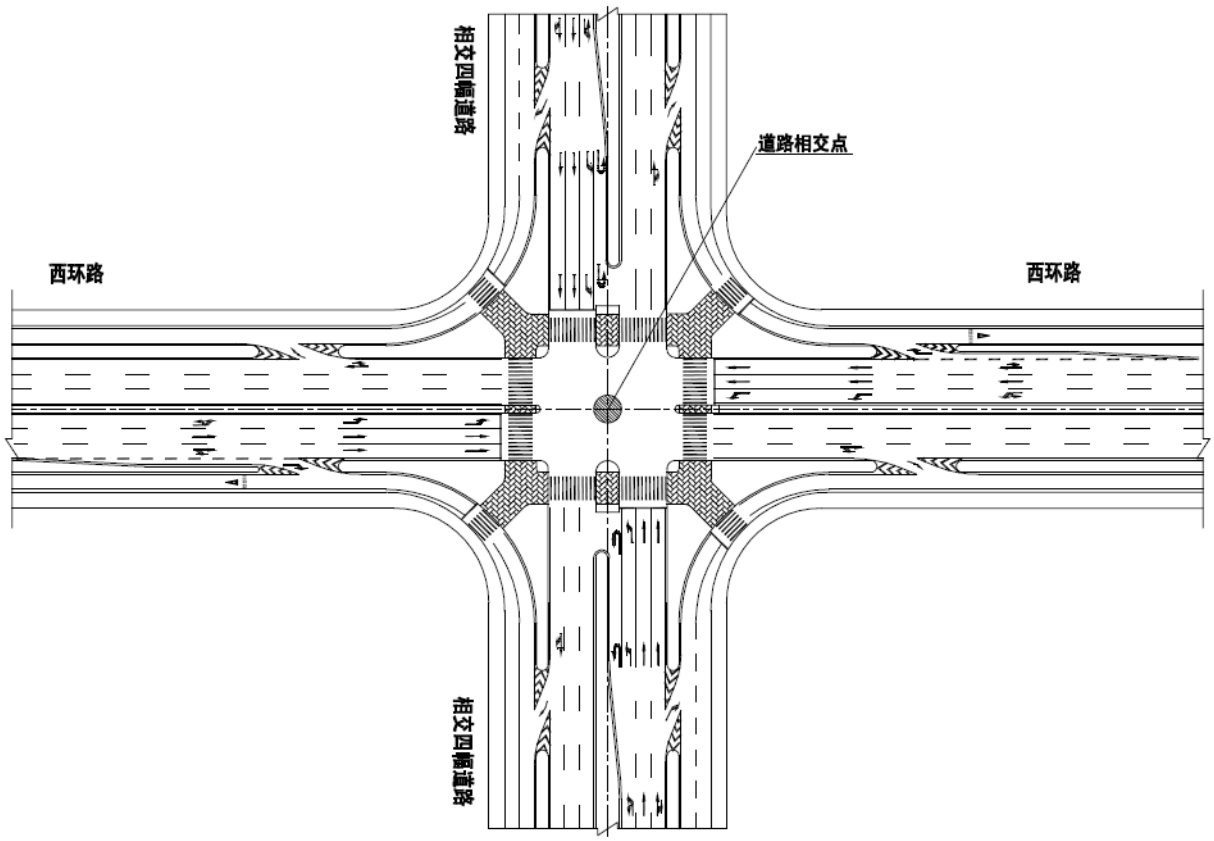


Figure 19: Typical Intersection Treatment

46. Widths of the main road sections are typically 50 meters with carriageway cross section of 26 meters. Pedestrians crossing at intersections are relatively well designed for with signals for pedestrian and bicycles. Zebra crossings are often provided, but the green phase for pedestrians may not be adequate for vulnerable users crossing wider roads.

7) Mid-section pedestrian crossing

47. Given the nature of the industrial park, high freight traffic flow is expected at many road sections. Speeding may be a concern at wider roads and drivers may often overlook pedestrians. Safe mid-section zebra crossings shall be adequately provided at intervals of no more than 300 meters.

Figure 20: Example of Signalized Zebra Crossing with a Refugee Island

8) Marking and signage

48. Marking and signage shall be provided properly in LIP to warn/remind of frequent truck traffic. The figure below shows examples of warning signs that fit the circumstances of the industrial area.

Figure 21: Examples of Warning Signs

49. Regarding road safety concerns, some of the key issues that will need to be reviewed and addressed include the following:

- Road widths – concerns with wide road width design and the constraints for NMT users such as severance, long crossing distances, discourage of green travel, increase of vehicle speeds, and fit with land use and poor road safety. Noting the issues around wide roads and crossing distances, pedestrian crossings should include a refuge area or be integrated with the medians, so that pedestrians can cross the road in two stages.
- Cross section – adequate provision of NMT, rights-of-way provided for pedestrians including both sidewalks and crosswalks helping to reduce conflicts and encourage more walking trips by providing a safer and more pleasant pedestrian environment. Channelization design will also be reviewed.
- Gradients should not be too steep in consideration of driving safety especially a large number of truck/lorry traffic is expected in LIP, and speed control measures (e.g., speed control humps) may have to be considered.
- Signage – pedestrian crossings and heavy goods truck/lorry warning signs can be set according to the local needs and PRC guidance sets out some principles.
- Stopping lines and advance lines for pedestrian crossings will be reviewed in accordance with guidance.
- Lighting provision will be reviewed.

9) Structure

50. **Bridge.** One medium-sized bridge is proposed for the road to cross the existing Dasha River. The design is considered adequate, but still at a conceptual level. A simply supported slab bridge is a normal practice for a short span bridge. It is relatively low cost, and easy for construction. For

the next step, a more detailed geological survey will need to be carried out before preparing the detailed design to determine the sub-structure and ensure accuracy.

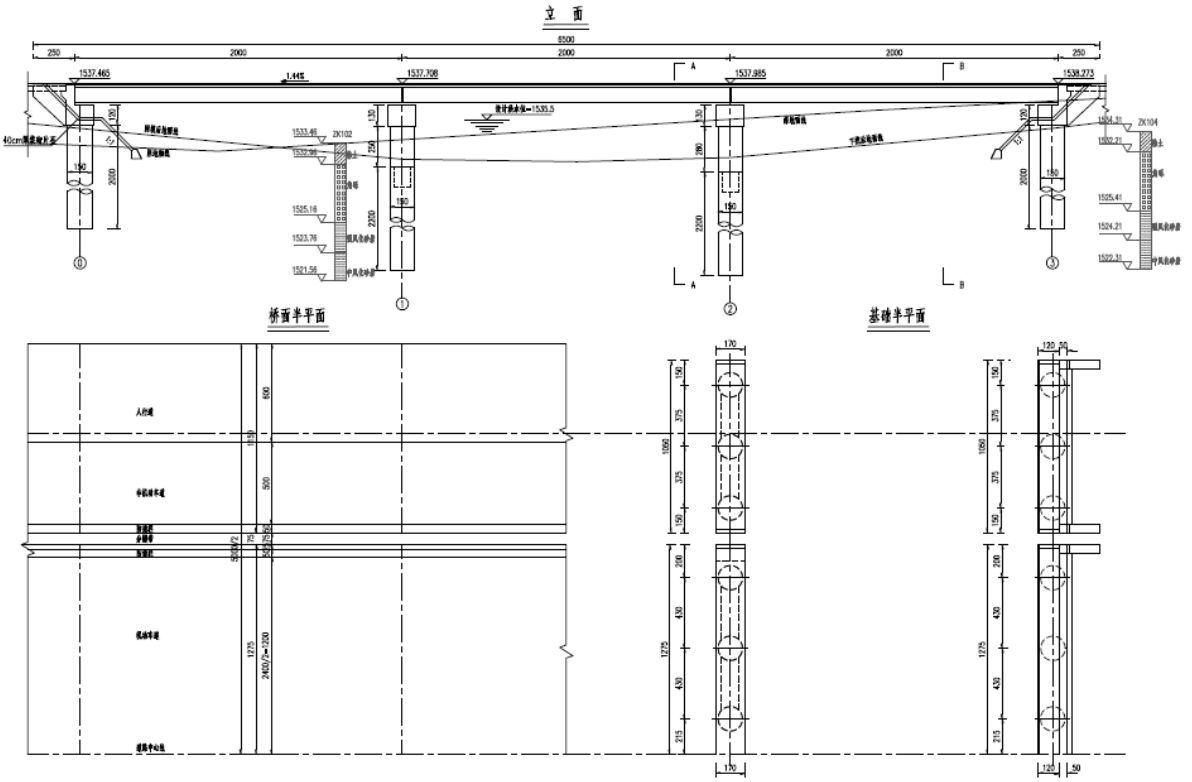


Figure 22: Elevation View of the Bridge

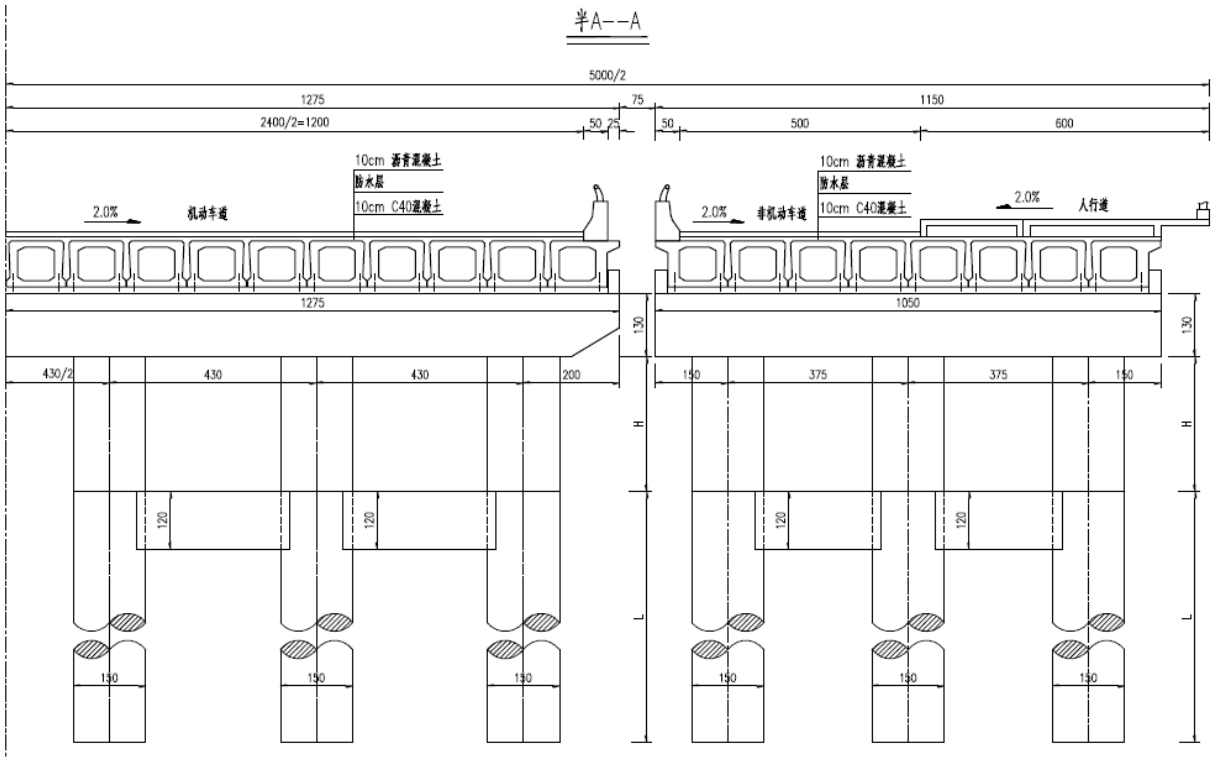


Figure 23: Section View of the Bridge

51. **Box Culvert.** Four box culverts are proposed in parallel for the road in the underpass of the existing G6 Expressway. Separate culverts are designed for MV for two ways, NMV + sidewalk, as a small span box culvert is more cost-efficient and easy for construction. The main box culvert

(MV) is designed as 24.74 m long and 12 m wide. A side culvert is designed at the same length and 9 m wide. In line with the design specifications, the height clearance is designed at 5 m.

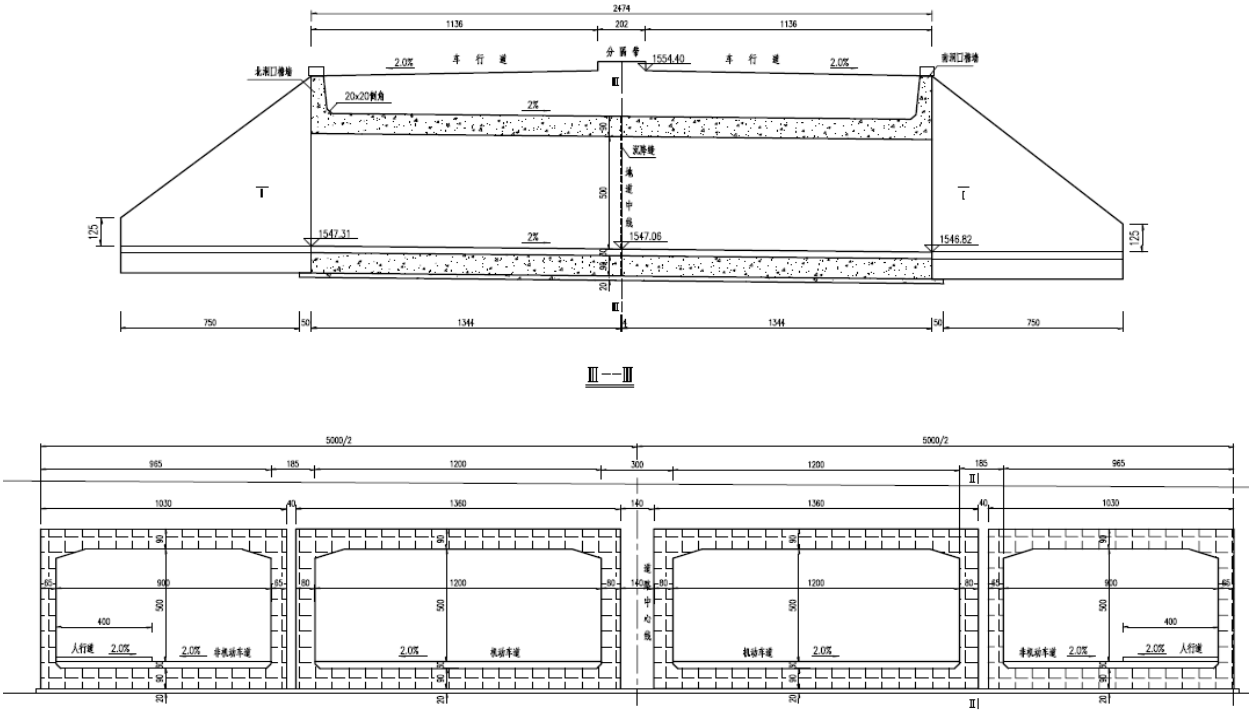


Figure 24: Elevation View of Box Culvert

10) Municipal Utilities and Others

52. A basic design for the public utility system was prepared in line with criteria set out in the detailed plan of the new area. Utility pipelines consisting of the drainage and wastewater system, water supply, lighting, traffic signaling system etc. will be laid under the greenbelt and sidewalk on both sides of the road. Proper depth and clearance for these facilities will need to be ensured. The water supply and wastewater collection systems are also designed under other subcomponents in this project. Pipelines for these utilities are considered in a coordinated manner and space reserved.

Drainage System

53. The drainage system is designed as gravitational flow and connected into the drainage network at downstream. Grade II reinforced concrete is proposed as the drainage pipe material and shallow burial will be adopted with depth of 1.3 m. Drainage manholes will be built at 40 m intervals.

Lighting

54. Street lights will be installed symmetrically along both sides of the road between MV and NMV lanes at intervals of 35 m. Lighting posts will be 10~12 m high. The average luminance will be no less than 28 lux,[1] and the lighting uniformity is designed at 0.62. A 10 kV power supply is proposed and connected to holistic city power grids. Since the interim mission, in consideration of energy saving, solar energy and optic diode lights have been adopted.

[1] The standard measure of luminous power per area

11) Implementation schedule

55. The construction of the road network was commenced in April 2012. The sub-grade of 10 roads is under construction; the subgrade of roads totaling 38.81 km long has been completed so far. The LMC has prioritized the construction of roads and proposed a construction schedule for the overall road network. A five-year roll out plan is shown in the table below. Availability of funding will need to be secured to ensure the program will be implemented as planned.

Table 16: 5-year Construction Program for the Road Network

Year	Activities
2012	Jinger Road, Yuanbei Road, Jingsan Road sub-grade construction
2013	Liuchuan Road, Jingyi Road, East Ring Road Yuannan Second Road, Yuanbei First Road, Jingwu Road Subgrade Construction, Jinger Road pavement Drainage Pipeline Network, Jingsan Road Sewage Pipeline Network
2014	South Ring Road, Yuannan First Road, Gongye Avenue subgrade construction and Gongye Avenue Jingsan Road pavement, pipeline network construction
2015	Xincheng Bei Road, Yuannan Road sub-grade, Liuchuan Avenue East Ring Road Yuannan First Road pavement and pipeline network.
2016	Yuanbei Road, Yuanbei First Road, Jingyi Road, Yuannan Second Road pavement and pipeline network.

12) Cost Estimates

56. Civil work quantities and costs in the FSR are provided in the Tables below and have been reviewed by the TA Consultants. Unit prices were derived from Indices for Municipal Engineering Work Cost Estimate, issued by the PRC Ministry of Construction in 2007. This is in accordance with domestic feasibility study preparation requirements. The unit prices include the unit cost of labor, material, and equipment. These prices were compared with those for other projects and market prices in the region and were found to be generally adequate.

Table 17: Civil Work Quantity and Cost

Civil works	Unit	Quantity	Unit price (CNY)	Sub-total (CNY1,000)	Sub-total ($1,000)
Pavement	m^2	301,100	260	78,286	12,750.16
Sub-grade	m^2	2,063,110	40	82,524.4	13,440.46
Bridge	m^2	1,500	6,500	9,750	1,587.95
Box culvert	m^3	1,795	9,000	16,155	2,631.11
Drainage	m	11,441.8	800	9,153.4	1,490.78
Sewage	m	9,033	950	8,581.4	1,397.62
Lighting		402	22,000	8,844	1,440.39
Water supply	m	8,000	900	7,200	1,172.64
Traffic engineering	km	6.02	400,000	2,408.8	392.31
Greening	km	6.02	466,667	2,810.3	457.7
			Total	**225,713.3**	**36,761.12**

2.7 Road maintenance

57. To strengthen the administration and improve the service level, a company called Greening Co. has been established under the LMC in April 2013. It currently has 19 staff including 5 on administration, 10 on sanitation works and 4 on public security. The company consists of administrative, financial, technical, maintenance, equipment, greening and planting, and security divisions etc. The Maintenance division under the Greening Co. is responsible for road, bridge, and drainage maintenance for primary/secondary roads in the industrial park. With the expansion of the road network, more staffing and funding will be required to maintain the level of public services.

58. The Maintenance funding would partially rely on municipal/county fiscal revenue and LMC's own revenue from land transfer etc. Marketable operation is encouraged to promote completion and generate more revenue. It is estimated maintenance budget will be increased 10% annually. Annual budget will be adjusted according to actual expenditure. With rapid expansion and building of more roads, maintenance issues will be becoming more acute. Sufficient funding will need to be secured.

59. Under current arrangement, the company mainly carries out routine maintenance works under the administration of the LMC. However, it is encouraged to separate the ownership and management authorities in the future. Competitive bidding procedures will need to be introduced for awarding civil work contracts with contract values exceeding a certain amount.

60. Road component is considered a non-revenue generating component. The EA/IA will need to secure sufficient counterpart funds during project implementation and funds for O&M during operations thereafter. Unit price (labor, material and equipment) for routine maintenance would be CNY1.2/m^2 at current price; and medium/big repair is expected every 5 years at the cost of five times of routine maintenance. Bridge maintenance cost will also need to be taken into account for financial and economic costs. For LIP, annual funds required for O&M for road component will be between 0.41% and 2.39% of projected fiscal revenue during operational stage. Although the analysis indicates that the technical and financial risks assumed by BMG, JCG and LIP in undertaking the O&M is acceptable, training will be conducted to strengthen their capacity for public asset management.

2.8 Key Issues and Next Steps

61. The engineering design at this stage is considered adequate and up to the level of details of FSR in line with domestic FSR preparation guidelines. The FSR has been improved and updated by incorporating the TA Consultants' comments. A few points especially on road safety and structure safety measures will need to be addressed during the next step of preliminary design. The key issues for engineering design are summarized as follows:

62. **Geological survey.** Geological survey has been completed. Design was carried out with reference to surveys for roads within the same area as well. However, the structural design will need to be improved by fully considering the geotechnical survey results during the next step of preliminary design.

63. **Road safety audit.** Road safety considerations should be given top priority during preliminary design, not only to the proposed Xihuan Road, but also to all the roads in the LIP. It is recommended to undertake road safety audit on the detailed design for all the roads within the LIP before approval of civil work contracts.

64. **Vertical alignment.** It is noted that the LDI is currently using the obsolete 1:2,000 topographical survey map. Updated survey is partially complete. But the surveys for the cross

sections have been completed, which will be sufficient for calculating earthwork quantities. The vertical alignment will need to be elaborated after obtaining the results of more updated topographic survey, to follow the landform as much as possible to minimize earthworks.

65. **Traffic engineering.** The FSR at this stage has not included a detailed traffic engineering design. For the next step, a detailed traffic engineering design, e.g. intersection channelization and barrier-free design shall be provided. Also, pedestrian safety and mid-block crossings will need to be fully considered. These should be carefully reviewed as part of the road safety audit.

66. **Structural design.** For the next stage of preliminary design, the structural design will need to be elaborated with full consideration of geological survey results to determine the form of the sub-structure; hydraulic data will need to be supplemented and calculation based on the data should be further examined. Sufficient headroom for the structures should be ensured. The construction methodology should be further studied as it would have significant cost implications. Existing structures and landform should be carefully studied through site investigations during the next stage.

SUPPLEMENTARY DOCUMENT 3 D
TECHNICAL ANALYSIS OF ITS COMPONENT

1 Task Overview

1. This Technical Assistance (TA) aims at defining the scope of the proposed Intelligent Transportation System (ITS) component of the Project. The ITS TA is to review proposed ITS strategy and design, suggest a suitable ITS component for ADB financing through identifying the most appropriate strategy and design, and provide innovative idea, concept, management approach and technology to effectively contribute to the designed project impact and outcome. Detailed descriptions of the tasks for the ITS specialists are as follows.

(i) Critically review the urban master plan, transport master plan, present traffic conditions and transport management, and identify traffic management needs in Baiyin District.
(ii) Review the preliminary design of the proposed ITS, refine and advise on the most suitable design by considering cost efficiency, system operation and expansion, long-term practicality, capacity of operators and other relevant factors;
(iii) Recommend other relevant factors to enhance sustainable transport management of Baiyin District, including design of urban road network and non-motorized transportation, segregation of heavy vehicles and freight transport for road safety;
(iv) Propose and design appropriate non-engineering measures (to supplement the proposed ITS) as enhancement measures for transport management in Baiyin District, including public awareness campaign and public education;
(v) Identify appropriate procurement packaging for the ITS;
(vi) Assess operation and maintenance requirement of the ITS, and financial and human capacity of ITS operational entity;
(vii) Advise on the transportation management plan and road cross-section design for the eastern Baiyin urban area including feeder transportation for industrial workers;
(viii) Analyze capacity development needs of the executing agency and an ITC operational entity, and conduct the training;
(ix) Prepare the required reports.

2 Objectives

2. The ITS component will comprise two systems for traffic control and public transport management respectively. Investment components are identified based on the analysis of short-, medium- and long-term ITS development strategy of Baiyin Municipality. The scope of the ITS component consists of: (i) a traffic police operation center, (ii) signal control, (iii) equipment for electronic police/video monitoring and violation recording/traffic guidance, (iv) a public transport operation center, (v) public transport onboard equipment, (vi) stop and depot equipment, and (vii) software. [1]

3. According to the Urban Master Plan of Baiyin District [2] and the Urban Road Construction Special Plan of Baiyin District [3], the urbanization and urban road development of Baiyin District can be divided into 3 stages:

(i) Short-term development: 2012-2015
(ii) Medium-term development: 2016-2020
(iii) Long-term development: 2021-2030

4. As the ITS will serve the transport and urban economic development, the detailed indicators reflecting urban and transport development stages can therefore be referred as the ones indicating ITS development stages. Selected indicators and values are shown in Table 1.

Table 1: Urban and Transport Development Indicators of Baiyin District [2] [3] [4]

Indicator	Year			
	2010	2015	2020	2030
01. Population	281,800	310,000	360,000	540,000
02. GDP (CNY billion)	7.8	10.8	14.6	25
03. Constructed urban area (km^2)	20.9	31.79	42.68	60
04. Road length (km)	80	97.64	115.28	150
05. Road area per capita (m^2)	5.89	10.05	14.21	20
06. Vehicle ownership	42,311	115,000	185,000	300,000
07. Average daily trips (person trips)	930,000	1,020,000	1,190,000	1,400,000

(Data Source: *Urban Master Plan of Baiyin District 2010-2020*, *Urban Road Construction Special Plan of Baiyin District 2012-2020*, and Statistical Bulletins of Baiyin District Government)

5. In the short-term transport development of Baiyin District, improvement of urban traffic order, reduction of traffic violations and accidents as well as strengthening of public transport serving capacity are the main tasks. In the medium-term development, with the growth of the economy, the expansion of the urban area, the formulation of road network, the gradual improvement of transportation infrastructure, and the further development of motorization, Baiyin District will face problems including traffic congestion, travel demand growth and transportation energy consumption. Thus, in the medium and long term, in order to achieve a gradual, healthy and green style transportation development for Baiyin, developing trends should be analyzed and solutions should be sought to deal with different demand-supply issues.

3 Methodology

6. The approaches the ITS Team has applied to finish the tasks include literature review, field study and interview.

7. Literature Review – The following documents and materials are reviewed: (i) *Urban Master Plan of Baiyin District 2010-2020* [2]; (ii) *Urban Road Construction Special Plan of Baiyin District 2012-2020* [3]; (iii) *Baiyin Twelfth Five-year Development Plan (12 FYP) for Urban Development* [5]; (iv) *Baiyin 12 FYP for Industrial and Information Technology Development* [6]; (v) *Baiyin 12 FYP for Highway and Waterway Transportation Construction* [7]; (vi) *Baiyin 12 FYP for Economic and Social Development* [8]; (vii) ITS component of the Baiyin-ADB Program Phase II Feasibility Study Report (FSR).

8. Field Study – A field study has been carried out in Baiyin District to get a direct understanding of transportation conditions in the urban area, to identify current and potential traffic management issues for suitable comments and suggestions on ITS strategy and design.

9. Interview – Key informants of the local government, project management office (PMO), local design institute (LDI), local traffic police and local public transport operator are interviewed.

4 Work Plan of the ITS Specialists

10. The work plan of the ITS Specialists was that from 1 November 2013 to 15 February 2014, two workshops were held in Baiyin. One of the two outcomes (inception report and interim report) for this stage was finished after each workshop. A detailed plan is shown in Table 2.

Table 2: ITS Specialists' work plan

Time	Work
1 – 17 November 2013	Communication with the Project Preparatory Technical Assistance (PPTA) Team, Baiyin Project Management Office (PMO) and Local Design Institute (LDI); collection of materials
17 – 30 November 2013	FSR review and Formulation of FSR review comments
1 – 2 December 2013	Inception mission in Baiyin
3 – 15 December 2013	Inception Report

15 December 2013 – 14 January 2014	Interim report
1 – 19 January 2014	Field study
20 – 24 January 2014	Interim mission in Baiyin
25 January – 20 February 2014	Final report

5 Review of FSR

5.1 Overview, Current Conditions and Issues

5.1.1 Scope of the Study

11. This TA studies the transportation and ITS developing conditions of Baiyin District, the central urban area of Baiyin City[1], and Gansu Province of the People's Republic of China (PRC). Comments and suggestions to the ITS development plan are for Baiyin District, based on the ITS component of the FSR.

5.1.2 Conditions and Issues of Transportation in Baiyin District

12. With the rapid economic growth, urbanization and motorization are rapidly developing in Baiyin, Gansu Province. While roads and motorized travel modes are bringing convenience to the citizens, the upgrade of transportation management equipment and techniques is dragging behind.

(i) Road resources

13. Currently Baiyin District has a total urban road length of 90.58 km with a per capita area of 8.39 m^2, which is lower than the nation's average of 9.3 m^2. [3] With the use of ADB loan for the Phase I Project, Baiyin District has carried out urban road renovation and expansion, which has improved road conditions and increased road capacities in recent years (Figure 1). **The urban road network of Baiyin District is coming into being; more road capacity is being provided.**

[1] Including two districts (Baiyin and Pingchuan) and three counties (Jingyuan, Huining and Jingtai)

Figure 1: Road network of Baiyin District (Source: Baidu Maps: http://map.baidu.com)

(ii) Vehicle ownership

14. The vehicle ownership in Baiyin District is 68 thousand, with a lane area per vehicle of about 26.06 m^2. Cities of similar scale in the PRC such as Shantou and Yibin have their lane area per vehicle of 22 m^2 (in Year 2006) and 12.4 (in Year 2007) respectively. Therefore, **the Baiyin District car ownership is relatively small considering the current urban road supply.** In fact, with the data showing that there are only 60% of the intersections of Baiyin District controlled by traffic signals, and there is similar low percentage of intersections equipped with monitoring facilities, **the most significant issue facing Baiyin District is the lack of transportation management equipment and the falling behind of traffic management techniques**.

(iii) Traffic conditions

15. Based on the field study in Baiyin District by the ITS Specialists, the 3.3 km measurement of the average vehicle speed on the east-west main corridor, Beijing Road, is 31.15 km/h; and the 1.9 km measurement of the average vehicle speed on the north-south main corridor, Gongnong Road, is 27.3 km/h (Figure 2).

Figure 2: Measured streets

16. The vehicle speed data provided by the Traffic Police of Baiyin District have substantiated the ITS Specialists' field study results, showing that the daily average vehicle speed on major roads of Baiyin District is 36.94 km/h. During morning, noon and evening peak hours, the average vehicle speed on major roads are 35.59 km/h, 33.65 km/h and 33.53 km/h respectively. Therefore, currently the traffic flows are smooth along most roads in Baiyin District.

Table 3: Vehicle speed on major roads (km/h)

Road	Daily Average	Morning Peak (7:00-8:30)	Noon Peak (11:45-14:45)	Evening Peak (17:30-18:30)
Yinshan Road	35	27	19	23
Dongshan Road	30	37	18	20
Park Road	**22**	**20**	**19**	**18**
Renmin Road	**23**	**21**	**17**	**20**
Gongnong Road	**28**	**30**	**27**	**25**
Binhe West Road	53	49	50	51
Binhe East Road	54	52	50	51
Chengxin Road	50	51	53	52
Dalian Road	50	49	58	53
G109	58	57	56	59
Chang'an Road	42	40	39	41
Beijing Road	**29**	**27**	**25**	**22**
Jianshe Road	50	49	50	49
Wangxian Road	31	28	29	27
Silong Road	**30**	**26**	**24**	**21**
Youhao Road	30	31	28	26
Hongxing Street	**13**	**11**	**10**	**12**
Average	**36.94**	**35.59**	**33.65**	**33.53**

Source: Traffic Police of Baiyin District

17. At present, there is no serious traffic congestion in Baiyin District, but minor- and medium-level congestion has started appearing in some nodes and sections during noon and evening peak hours, as well as the weekends (Figure 3).

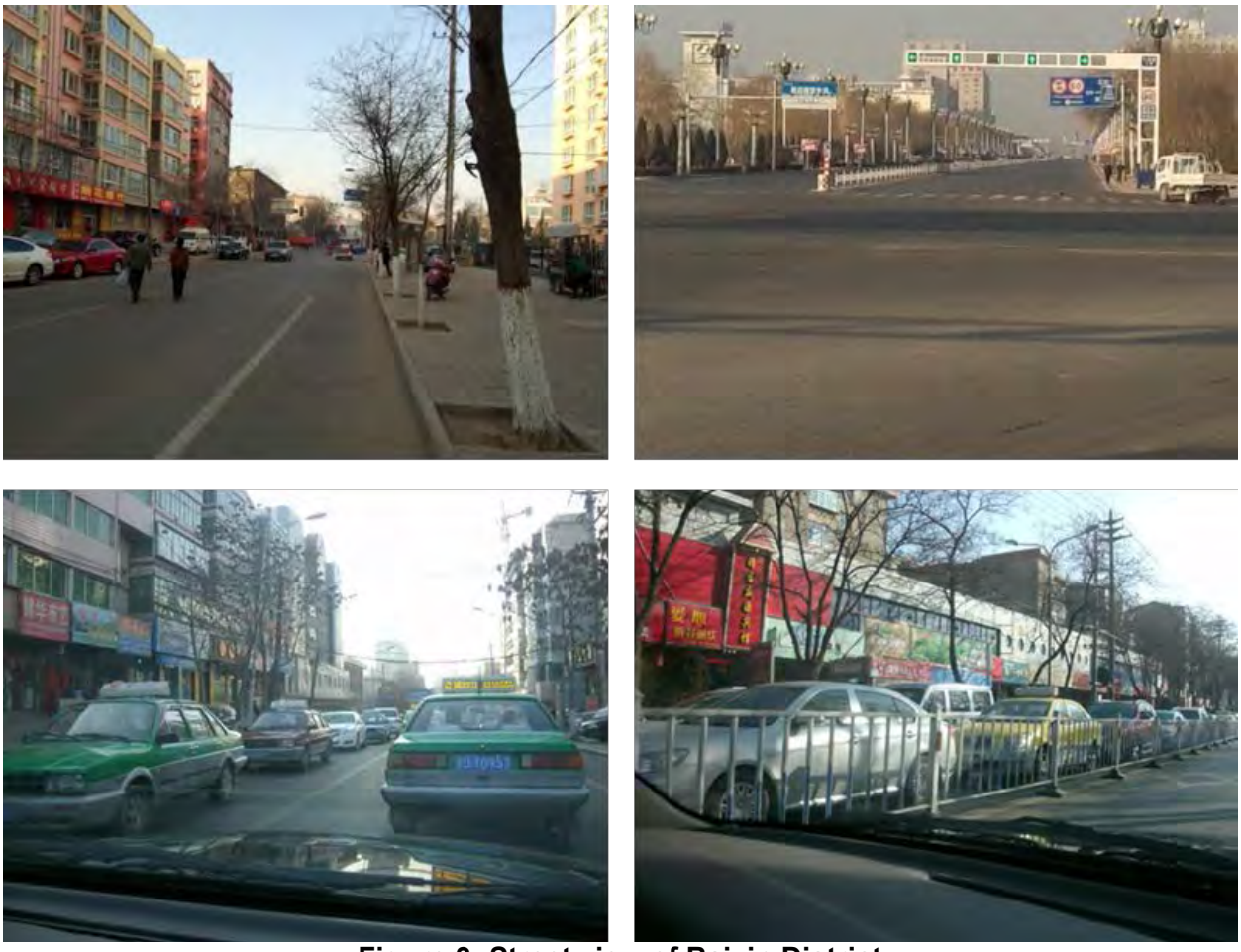


Figure 3: Street view of Baiyin District

18. Congestion appears at the intersections between Renmin Road, Park Road, Gongnong

Road, Beijing Road, Silong Road, Hongxing Street and road sections near school gates. This can also be identified from the vehicle speed data in Table 3, showing that the vehicle speeds on these six roads are the lowest.

Figure 4: Main congested areas in Baiyin District

19. According to observation of traffic conditions and interviews with local residents, the major causes of congestion in Baiyin District are: (i) traffic chaos, (ii) traffic accidents, and (iii) sharp increase of traffic near schools when parents picking up children.

(iv) Traffic order

20. Traffic violations frequently appear on major roads in Baiyin District, as shown in Figure 5. Traffic chaos at non-signal controlled intersections, illegal parking, and illegal road-crossings are three major types of traffic violation. These violations involving motor vehicles and pedestrians are becoming potential risks to the safety of road users in Baiyin District.

Figure 5: Traffic violations in Baiyin District

21. According to the traffic violation and accident statistics, from 2010 to 2013, the number of traffic violations in Baiyin District increased by 536.3% from 12,025 to 76,519, as shown in Figure 6. Also, the number of traffic accidents increased by 1.7% from 1,211 to 1,232 (in which major accidents, the ones that caused injuries and property losses, increased by 94.3% from 35 to 68), as shown in Figure 7. Therefore, **the biggest transportation problem for Baiyin District is the increase of traffic chaos and accidents which need to be dealt with immediately.**

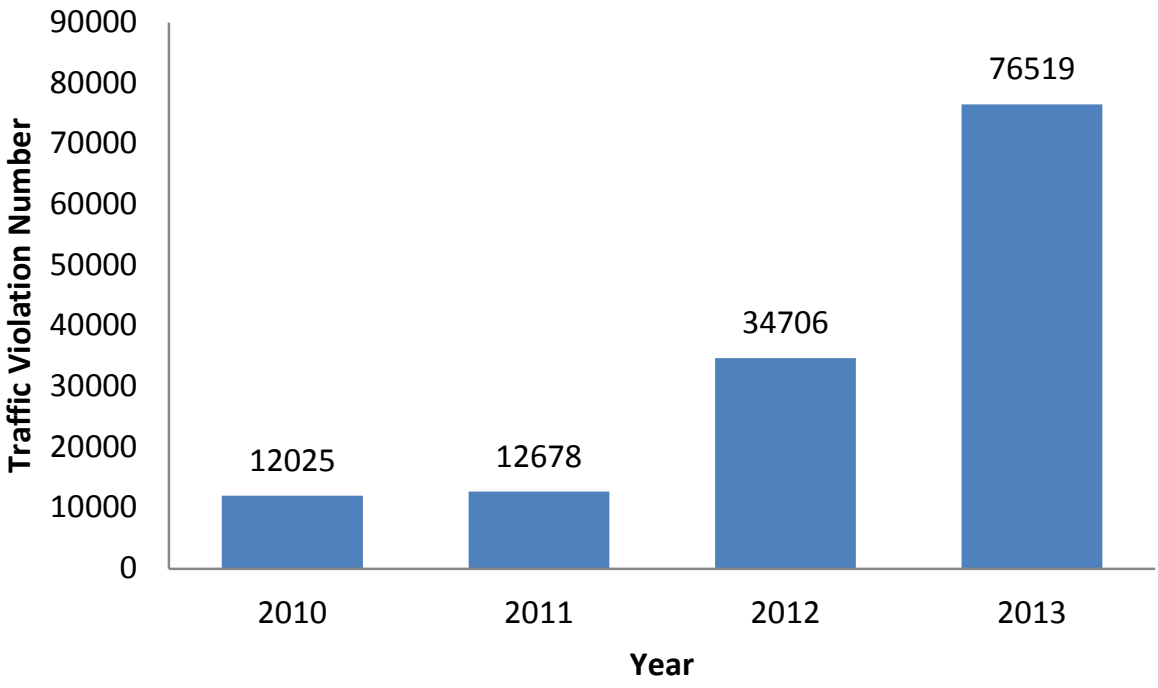


Figure 6: Traffic violation numbers in Baiyin District

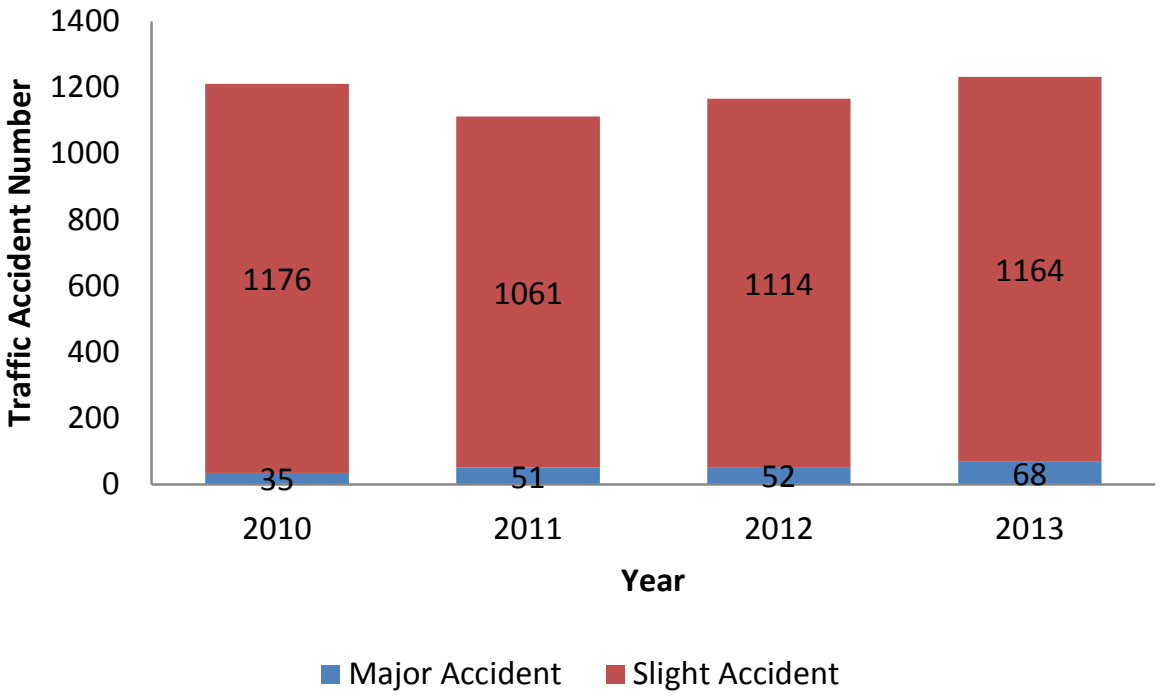


Figure 7: Traffic accident numbers in Baiyin District

(vi) Public transport

22. There are currently 200 buses serving Baiyin District on 13 lines. The total length of operating bus lines is 36 thousand km. The daily passenger volume is 130,000 person trips. The bus vehicle ownership is 4.21 standard units per 10 thousand people. The bus lines have covered most urban roads in Baiyin District. Large capacity buses, dual-fuel and low-emission buses accounted for over 87% of the total. The IC bus card system was established in 2008, and is also connected with other 33 cities in the PRC including Lanzhou. (Figure 8)

Figure 8: Baiyin bus fleet / Baiyin IC bus card

23. Buses and bus stops are often crowded during peak hours. Security incidents happen occasionally. When a major public event, man-made / natural disasters or accidents happen, the bus company cannot effectively implement cooperative scheduling and management of urban public transport resources. The collaborative emergency response capacity is weak, making

significant threats to urban public security. (Figure 9)

Figure 9: Bus and bus stop in operation in Baiyin District

24. For evaluation of the current performance of public transport services in Baiyin, the Transit Metropolis evaluation indicators can be referred to. [9] The ITS Specialists have selected some of the main indicators (Table 4) from the supply, service, infrastructure, safety and financial aspects, which can provide an overall view of Baiyin public transport performance.

25. It can be seen from Table 4 that the current public transport services in Baiyin District still need improvements in supply, service and infrastructure.

(i) Higher level of supply is needed to enhance the attractiveness of public transport, which can be reflected by bus ridership.
(ii) Although the passenger satisfaction ratio is relatively high, public transport in Baiyin District still faces problems of low operating speed and undesirable punctuality ratio.
(iii) Operation infrastructure is relatively adequate except intelligent and prioritizing facilities, which are the objectives of ITS development.

Table 4: Public transport performance evaluation using Transit Metropolis indicators

Aspect	Indicator	Current situation in Baiyin District
Supply	Bus ridership (excluding walk)	**36.78%**
	Bus network density in built-up area (km/km^2)	**2.33**
	Standard bus unit number per 10,000 people	**4.21**
Service	Bus stop 500-meter-radius coverage ratio	90.5%
	Average peak-hour operating speed (km/h)	**20**
	Punctuality ratio	**60%**
	Average load ratio during peak hours	90%
	New energy vehicle ratio	87%
	Passenger satisfaction ratio	82%
Infrastructure	Depot parking ratio	100%
	Arterial road bus bay ratio	3.75%
	Signal priority ratio	**-**
Safety	Bus-responsible traffic accident ratio (issue/million km)	0.09
	Bus-responsible traffic accident annual fatality ratio (person/10 thousand bus units)	4
Financial	IC bus card use ratio	90%
	Bus company employee average income/local average income	0.95

(iv) Safety of public transport is good, without many traffic accidents happening. However, public order in operating vehicles and stops should be enhanced.

(v) Financial situation of local bus company is fine. The income of bus company employees has opportunities to be increased by achieving more efficient operation and more attractive service.

26. In the **short-term** transportation development of Baiyin District, **improvement of urban traffic order, reduction of traffic violations and accidents as well as strengthening of public transport serving capacity** are the main tasks. In the **medium-term** development, with the growth of the economy, the expansion of urban area, the formulation of road network, the gradual improvement of transportation infrastructure, and the further development of motorization, Baiyin District will face problems including **traffic congestion, travel demand growth and transportation energy consumption**. Thus, in the medium and long term, in order to achieve a gradual, healthy and green style transportation development for Baiyin, developing trends should be analyzed and solutions should be sought to deal with different demand-supply issues.

5.1.3 Current Conditions and Issues of Transportation Management

(i) Road traffic management

27. The current traffic management agency is the Traffic Police Division (TPD) of Baiyin Policy Department (BYPD). TPD is responsible for the maintenance of the traffic order in the city and public order on highways, and deals with traffic accidents. TPD also takes charge of motor vehicle management, driver licensing, road transportation safety education, inspection and supervision of traffic safety enforcement; and participates in road infrastructure construction planning and traffic safety researches.

28. Currently TPD mainly uses traditional traffic management methods that are inefficient and involve a great amount of manpower with little assistance of information technologies. TPD can hardly obtain a comprehensive and accurate understanding of the city's traffic conditions without the assistance of intelligent traffic management systems and equipment. Therefore, TPD cannot make rapid responses to different types of traffic violations and accidents, or carry out flexible operations on urban traffic flows.

29. For Baiyin District, strengthening traffic safety management is the priority mission at this

stage. While traditional management pattern and methods can hardly meet the demand of urban development, advanced technologies should be brought into the operation of TPD, to continuously upgrade traffic management systems.

(ii) Public transport management

30. Baiyin Public Transport Co. is still applying traditional manual dispatching which is inefficient. Because of the low dispatching capacity and the influence of crowded traffic during peak hours, the bus transportation capacity cannot be fully utilized, and passenger travel demand cannot be met. The operation management of the local bus company is extensive, without a standardized modern enterprise management system. The management of human resources, supplies, vehicles, maintenance and emergency response is not scientific.

31. The public have limited access to travel information. At present, passengers in Baiyin cannot obtain enough information including optimal routes, travel time, travel expenses and others to make a plan before travel. It is also difficult for passengers to know accurate vehicle location, arrival time, line adjustment and other timely information during travel. These difficulties in obtaining travel information lead to longer waiting time and more unnecessary journeys. For a city in Northwestern China like Baiyin, long waits at bus stops during cold winters have brought complaints from passengers, which have negative impact on the bus services' image.

5.1.4 Current Conditions and Issues of ITS

(i) Traffic police ITS

32. According to the FSR, the current traffic police management systems and facilities are shown in Table 5.

Table 5: List of Current Traffic Police Management Systems and Facilities

Item	Current Conditions
BYPD Center	Video monitoring, monitoring or running red lights, public security monitoring, GPS positioning (only police handheld devices) based on the **P-GIS Platform** An **analog signal large screen display system** constructed in 1993
Traffic Signal Management System	Single point controlled, with fixed phasing
Traffic Video Surveillance System	500 monitoring spots used for public security management and manual traffic violation screen capture, **based on P-GIS Platform**
Electronic Police System	108 sets of E-Police equipment on major intersections, with **data transmitted to P-GIS Platform**.
Dynamic Violation Monitoring and Recording System	Violation monitoring, recording and manual screen capture through video monitoring equipment and **P-GIS Platform**
Data Storage	Data storage is separately combined with different systems, with no connections between each other.

33. Baiyin District now has the BYPD Operation Center and its P-GIS Platform, with four management systems (Traffic Signals, Video Monitoring, Electronic Police, and Violation Monitoring/Recording) and data storage modules. The four systems are independent from each other, with no information or data connection. Among the four systems, Video Monitoring, Electronic Police and Violation Monitoring/Recording are based on P-GIS Platform. The current ITS framework is shown in Figure 10.

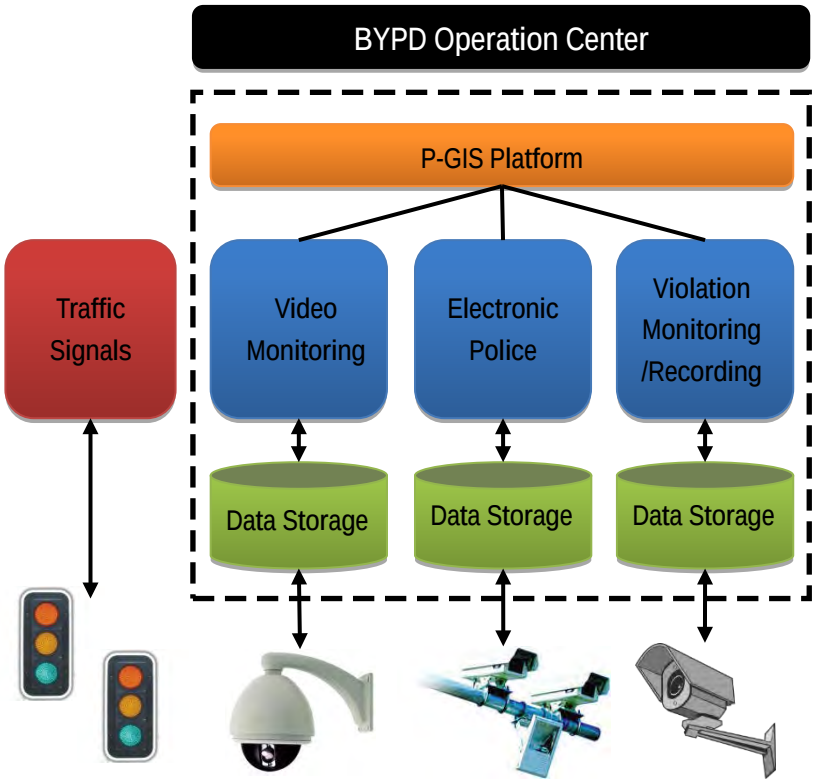


Figure 10: Current ITS framework of Baiyin District

34. Baiyin Traffic Police had stopped using the old operation center and machine rooms because of the frequent breakdowns and equipment aging. However the old operation hall can be renovated for the new operation center. Another very good option is the large meeting room on the 7th floor of Baiyin Traffic Police building, since it is currently seldom utilized and has an area large enough for a new traffic operation center plus a more advanced and useful video conference room. (Figure 11)

Figure 11: Existing traffic police operation center infrastructure and facilities

(ii) Public transport ITS

35. Current public transport management systems and facilities of Baiyin Public Transport Co. are shown in Table 5. Baiyin Public Transport Co. now has an IC bus card center with a system to support IC bus card ticketing and ticket revenue clearing. The operator depends heavily on traditional manual operational methods, with no intelligent operation system to support the scheduling, dispatching and real-time monitoring of buses. GPS based stop announcement equipment and SD card based video storing equipment support on-board service and monitoring.

Table 5: Current Public Transport Management Systems and Facilities

Item	Current Conditions
IC bus card system	On 1 August 2008, the IC travel card system was formally launched. The total number of cardholders has reached 227 thousand, 2,420 among which are national interconnection bus cards. The national interconnection cards are valid for bus services in 34 Chinese cities. The annual income from Baiyin bus IC cards is CNY40 million.
On-board stop announcement system and GPS positioning system	Currently the system can realize check-point bus stop announcement through built-in GPS, without other extensions.
Vehicle monitoring system	The vehicle monitoring system uses SD card to store video from 4 sources, without network interface.
Control center (including machine room)	Currently there is one IC bus card operation center with machine room.
Operation and scheduling system	Manual scheduling and dispatching is applied currently.

36. The IC card center of Baiyin Public Transport Co. is working well, and has been planned to be expanded in the future. On-board equipment faces aging and elimination. (Figure 12)

Figure 12: IC bus card center and equipment

37. Transportation in Baiyin District is rapidly developing, with its population, car ownership and infrastructure construction increasing gradually. The current traffic management systems and facilities will not meet future demand. At present, Baiyin District's ITS faces three major problems: (i) the lack of traffic information infrastructure, which cannot provide traffic managers timely and accurate information and data; (ii) the separation of intelligent traffic management systems, which has a negative influence on managers' scientific and rational decision-making; (iii) the lack of intelligent management measures for public transport, which prevents the effective utilization of public transport resources and the achievement of travel information service.

5.2 Demand for ITS Development

5.2.1 Short-Term Demand Analysis

(i) Traffic police

(a) An integrated traffic operation platform to achieve comprehensive traffic management and control

38. Without the sharing of information and the unified management of data, the functions and effects of ITS cannot be fully exerted. Without specified traffic control center and platform for Traffic Police, the overall effectiveness of traffic management will be greatly reduced. Therefore, it is urgent for Baiyin to build up a specific traffic control center with traffic management and control platforms to integrate different functional systems and further to improve the comprehensive traffic management level.

39. As the core of traffic police ITS, traffic management and control platforms can process various types of dynamic and static data, and integrate traffic condition, violation and abnormal event information. With a rational decision-support systems and emergency management mechanism, the data and information can be provided to the transportation management staff of different departments as the basis for transportation planning, traffic operation and violation handling.

(b) An adaptive signal control system to improve transportation safety

40. As the functions of intelligent signal control and violation monitoring still need to be improved, the number of traffic violations is increasing in Baiyin District. Illegal lane changing and running red lights are common cases. Mixtures of motor vehicles and non-motorized traffic can be seen everywhere. However, the current traffic police force cannot meet the demand for violation monitoring and prosecution.

41. An adaptive signal control system can automatically change the signal phasing of traffic lights according to the change of traffic volume, maintaining a reasonable signal timing, in order to minimize the delay at intersections and help smoothen urban road traffic flows. Also, with open protocols the system can be expanded with guidance, monitoring and recording facilities.

(c) A comprehensive violation processing system to strengthen traffic enforcement

42. Baiyin District has built up some traffic violation data collecting facilities at a few road sections and intersections. The old facilities and systems need to be upgraded or replaced to add functions of collecting more types of traffic violation information (illegal U-turn, illegal parking, illegal yellow line crossing or cross-lane driving). At the same time, the equipping of traffic violation monitoring and recording facilities should keep pace with the construction of urban roads, by building facilities in blank areas to expand the cover of intelligent traffic management. Also, connections with management systems should be built to effectively support the violation data processing capabilities.

(d) A unified road traffic database to provide data service

43. The data resources dispersed in every independent system have a lot of crossover and intrinsic closely related content. By integrating information resources, a public resource pool can be formulated, with data type being regulated and data resources being shared. Thus, transparent management of upper-lower business regulation and support to emergency disposal can be achieved; an efficient ITS can be improved. It is essential for Baiyin District to build up a road traffic database.

(ii) Public transport

(a) An integrated operation and information platform to achieve overall management of public transport services

44. As the core of Baiyin public transport ITS, the integrated operation and information platform can achieve automatic collection of bus positioning information and operation information, so as to overall monitor and manage all bus operation factors within the aspects of drivers, vehicles, lines, stops, depots and roads. Also, the platform can provide bus service information to passengers through various dissemination measures.

(b) An intelligent operation management system to improve transport efficiency by the use of existing resources

45. The intelligent operation management system has two major aspects of functions: (i) intelligent scheduling and dispatching, and (ii) bus company enterprise resource planning (ERP).

46. Through collection of location, operational status and other information by vehicle GPS, video and other real-time terminal equipment, the bus company can achieve the monitoring and management of vehicle position, entry and exit, speed, driving behavior and other aspects. The system can also be helpful in bus schedule planning, dynamic scheduling, intelligent dispatching and control.

47. The ERP functions including the management of vehicles, supplies, human resources, safety and ticketing. Different functional modules can record, organize, analyze and evaluate daily operational information of the bus company.

(c) A public transport information system to provide passengers bus service information

48. To meet the demand of convenient public transport travels, a public transport information system can be built. The system can provide information service for every stage of people's travel. Before travel, the system can provide information including mode choice, estimated travel time, estimated travel cost, bus stop maps, and dynamic traffic conditions through the Internet, mobile phone WAP, or call center services. When waiting, the system can provide information including the estimated arrival time, bus crowded level, bus line maps, transfer schemes, and operation schedule through mobile phone or electronic bus board. When the bus is traveling, information of its estimated arrival time and transfer schemes can be provided to the system through vehicle stop announcement, electronic stop maps, built-in screen, bus TV or mobile phone.

(d) A public transport database to serve both bus operator and the city

49. The public transport database can store and organize bus operation data (position, speed and others) and video monitoring data (interior and exterior). All data will become shared resources to support bus operation and emergency response. Video monitoring data can be shared with traffic police through granting of permission of the connection and access. Thus, the public transport database can simultaneously provide data support and information services to government enforcement, enterprise operation and people's travel.

5.2.2 Medium-term Demand Analysis

(i) Traffic police

(a) A traffic information collection system to expand information collection range

50. With the further completion of Baiyin District's road network and the further growth of traffic

volume, requirements of transportation management level will be raised. Therefore, it is essential to gradually achieve a comprehensive understanding of the urban road traffic conditions. In the medium term of Baiyin District's ITS development, traffic information collection's geographical scale and type range should be expanded. On the basis of short-term expansion of violation monitoring and recording facilities, other types of traffic information collecting facilities need to be added, including pavement loop detectors, video detectors, microwave detectors and infrared detectors, to collect road traffic volume, speed, occupancy and other types of data. Simultaneously, the road traffic database needs to be expanded as well, to provide additional storage space and management functions for new information.

(b) A travel information service system to provide travel information dissemination service

51. In the medium-term development, Baiyin District will face issues such as traffic congestion and the increase of transportation energy use and emissions. Providing travel information services will be the major task for the ITS development during this stage, to help transportation users make travel decisions, improve traffic demand macroeconomic regulation level and increase road utilization. At that time, advanced traffic data analyzing technologies and information dissemination methods need to be applied.

52. A Traffic Monitoring and Information Platform can be built under the TPD Operation Center; and an Information Release System can be built upon the platform. This system will obtain data from Baiyin Urban Traffic Database and disseminate different types of travel information after analyses and calculations. Information can be released through the Internet, interactive TV, telephone, mobile phone, traffic radio, GPS navigators, variable message signs (VMS), and electronic station board. Information types can include travel information before departure (travel speed forecasting, queue length forecasting, travel time forecasting, traffic accident information and clearing time forecasting); travel information during travel (travel speed ahead, queue length ahead, traffic accident information, traffic congestion level, travel time ahead and traffic control ahead); traffic control information; route guidance; parking information; road work information and others.

(ii) Public transport

(a) An emergency response system to realize Traffic Police – Public Transport joint actions on public transport-involved security incidents

53. With the connection between the urban traffic database and public transport database as a basis, the traffic police can have access to interior bus video information which is helpful to the handling of onboard security incidents. However, a joint emergency response mechanism is needed for the handling of future public-transport-related security incidents, which possibly include on-road traffic incidents and onboard security incidents. An emergency responding system can be built within the public transport operation center, and connected with the traffic police operation center to: (i) implement emergency dispatching of buses by the bus company; (ii) achieve Traffic Police – Public Transport joint actions on bus-related emergencies.

(b) The integration with IC bus card center to achieve meticulous operation and financial management

54. The IC bus card center is now an independent one operating and managing IC bus card ticketing of the bus company. There are currently an IC bus card management system and a standard machine room for the center. After the construction of the public transport ITS and its operation for a certain period of time, the IC bus card center can be connected with it. The integration of the IC bus card center and the PT operation center will lead to the combination of bus operation data, company operation data, passenger origin and destination (OD) data and IC bus card consumption data will enrich approaches and tools for: (i) passenger volume analysis and bus network planning; and (ii) staff performance and financial management, so as to

improve the operation efficiency of the bus company.

5.2.3 Long-Term Demand Analysis

ITS system expansion to achieve city-wide transportation management and travel information service

55. Future urbanization and economic growth demand of Baiyin City will cause the demand for transportation development, as well as ITS development in the rest urban areas of the city. With the preliminary completion of Baiyin ITS framework and successful operation within Baiyin District, the time will be right for Baiyin City to expand the systems to the whole city area. Apart from Baiyin District, Pingchuan District, Jingyuan County, Huining County and Jingtai County will then be the key areas for future ITS expansion. The expansion will include system upgrade, database expansion and external facility construction.

5.3 Technical Analysis

56. Based on the further communication and close cooperation with Baiyin PMO and LDI from November 2013 to February 2014, as well as the document and field study, the ITS Specialists have obtained a deeper understanding of Baiyin District's transport conditions, ITS development situations, as well as the expectations of the local government, enterprise and residents. The ITS Specialists have revised the technical analysis for the final stage. This TA is based on the January 2014 Version of the FSR.

57. According to the review of the ITS part in the FSR, the ITS Specialists are of the opinion that the current FSR has (i) given an objective description of the project background and current conditions; (ii) carried out fairly reasonable analysis of traffic management demand; (iii) systematically elaborated the necessity and feasibility of ITS construction for Baiyin District; (iv) provided clear objectives and specified construction components; (v) estimated project effects; and (vi) proposed a rational investment amount.

58. In the interim report, the ITS Specialists pointed out three issues for the FSR to be considered in its revision. After the interim mission, the ITS Specialists provided further guidance to the LDI on the revision of the FSR. The LDI has made some modification and improvements to the FSR, which can be seen from its new version. Detailed response to the ITS Specialists' comments on the three issues can be seen in Table 6.

Table 6: FSR modification / improvements in response of interim comments

Issue	Modification / Improvement
01. Modify and improve the FSR according to the inception suggestions	Suggestions considered; modification and improvements done in the new FSR
02. Design new ITS framework including public transport component	LDI, together with the ITS Specialists, worked out the framework design of an ITS with public transport component and added it into the new FSR.
03. Finalize the investment estimation	Baiyin PMO and ADB finalized and agreed investment estimation.

59. For the final stage of the ITS component TA, the following contents are included: (i) the final framework design for Baiyin District ITS, (ii) a performance evaluation of the ITS; and (iii) final investment and operating cost estimation of the ITS.

5.3.1 ITS Framework Design

60. The LDI prepared an updated version of FSR on 31 December 2013, with detailed investment estimation. The ITS component of the FSR underwent some modification corresponding to the comments provided by the ITS Specialists. For the updated FSR, the ITS Specialists made comments and suggestions for the following three issues.

(ii) New ITS framework with public transport component added

61. The *Memorandum of Understanding of the Inception Mission* stated "(the ITS) will enable the Baiyin city area to promote better safety and use of public transportation by using the information and communication technology". Therefore, it is necessary for Baiyin to add a certain part to promote the use of public transport. Considering the current conditions of public transport development in Baiyin District, a public transport ITS should be built. ADB and Baiyin PMO also agreed on the introduction of a public transport ITS into the Baiyin District ITS framework.

62. On the basis of existing bus GPS monitoring and management system and electronic equipment, Baiyin Public Transport Co. can build an intelligent public transport system with information, digital and automation technologies. This system should be able to provide functions including intelligent scheduling and information services, with interfaces for value-added functions. The whole system is relatively independent, but is connected with the traffic police ITS for data sharing, and to be connected with other urban information systems in the future.

63. According to the above idea, and based on the short-term, medium-term and long-term plan, the framework design for Baiyin District ITS is as follows.

64. **Short-Term:** Make use of ADB loan for this program to build a "1 center, 1 platform, 4 systems and 1 database" framework for Baiyin Traffic Police; and build a "1 center, 1 platform, 2 systems and 1 database" framework for Baiyin Public Transport Company.

65. For Baiyin Traffic Police, the construction of Traffic Police Department (TPD) Traffic Control Center, Traffic Safety and Control Platform (including Signal Control; Video-based Violation Enforcement; Electronic-police; and Traffic Guidance Systems), Baiyin Urban Traffic Database as well as traffic signals and video monitoring equipment are major tasks. Upgrade road traffic operation patterns, improve the efficiency of law enforcement, and make efforts to solve the problems of chaotic traffic and the increase of traffic violations and accidents.

66. For Baiyin Public Transport Co., the construction of Baiyin Public Transport (PT) Operation Center, Bus Operation and Information Platform (including Bus Operation and Bus Information Systems), and Baiyin Public Transport Database are major tasks. Improve bus operation measures and provide bus information services to enhance public transport safety, efficiently utilize public transport resources, and bring travel convenience to public transport users.

67. Detailed short-term ITS framework design is shown in Figure 13.

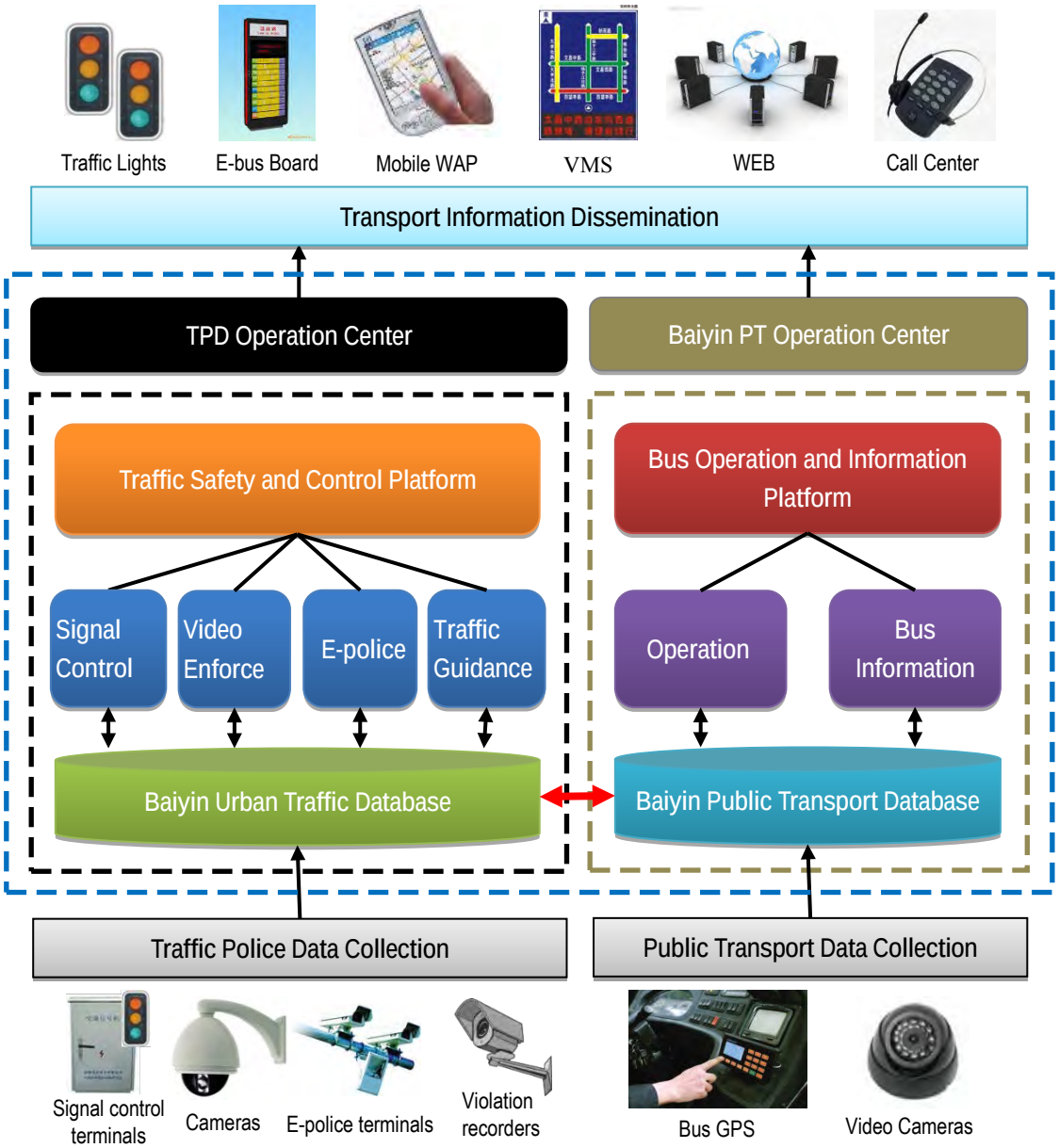


Figure 13: Short-term framework design for Baiyin ITS

68. **Medium-Term:** For Baiyin Traffic Police, the urban traffic database will be expanded and traffic monitoring and information platform will be built up. By expanding the scope of the traffic information collection, increasing the types of traffic information acquisition, and expanding storage space for traffic information, a comprehensive understanding of Baiyin District's road traffic information can be obtained to further flexibility in the operations on road traffic and readiness to serve road users. By providing road traffic data to travel information services, the traffic police can achieve efficient road traffic operation; and the city residents can enjoy personalized travel information services.

69. For Baiyin Public Transport Co., an emergency response system will be built up on the bus operation and information platform, and the IC bus card center will be integrated into the PT operation center. Appropriate vehicle data collection equipment will also be installed on buses. The emergency response system will be built on the bus operation and information platform, and connected with TPD operation center. Thus the traffic police and the bus company can collaboratively handle bus-involved traffic violations / accidents, onboard security incidents, and city events. The integration of the IC bus card center and the PT operation center will lead to the combination of bus operation data, company operation data, passenger origin and destination (OD) data and IC bus card consumption data. Thus it will help the bus company to develop better

bus network plans and improve enterprise management efficiency.

70. The detailed Medium-term ITS framework design is shown in Figure 14.

71. **Long-Term:** Expand the ITS system to the whole city, upgrade the systems, expand the capacity of databases and build more information collection and dissemination facilities. Through the expansion, an overall transportation management in the “2-district, 3-county” areas can be achieved.

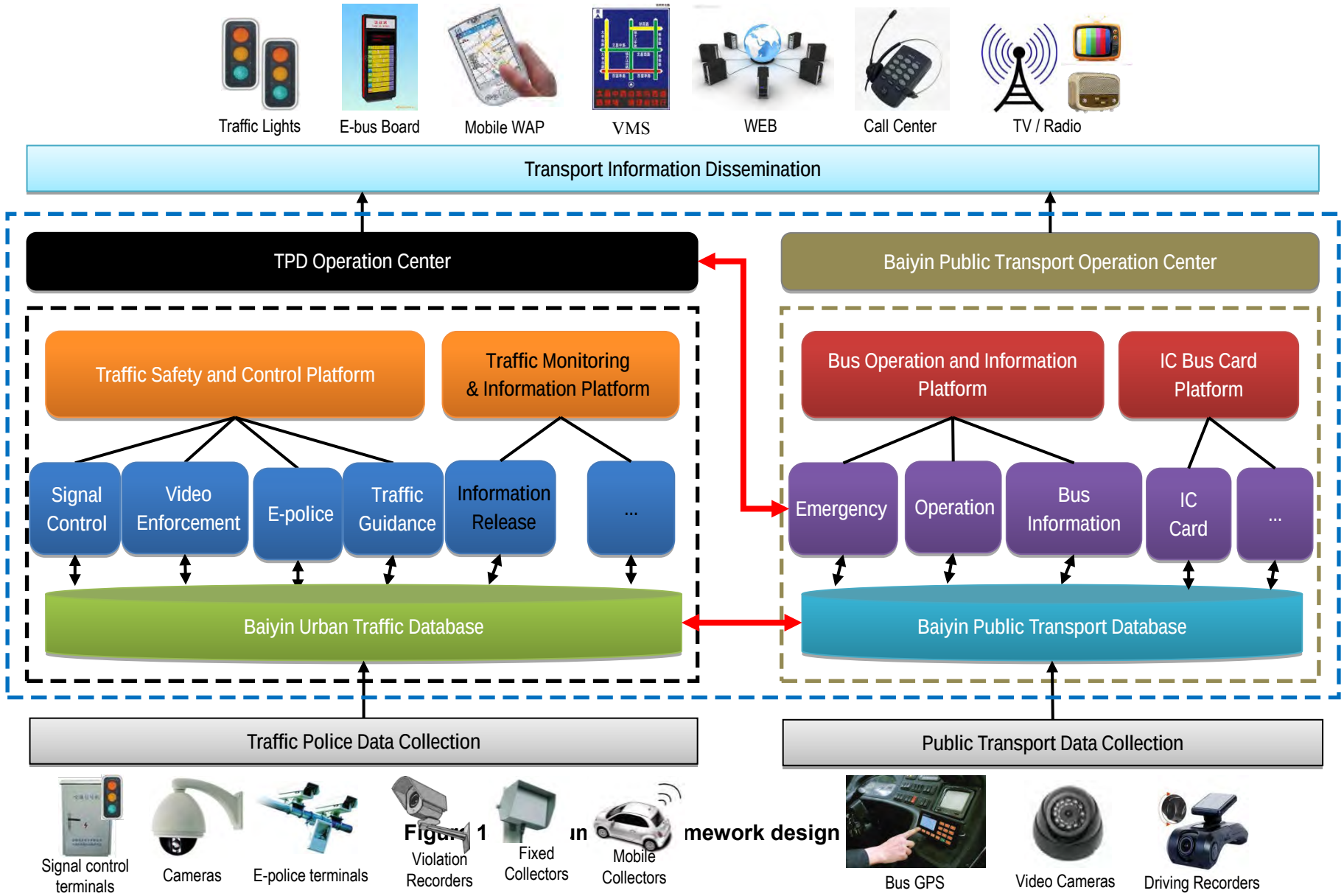


Figure 1 ... mework design

5.3.2 ITS Performance Evaluation

72. As an effective tool for traffic and public transport management, the Baiyin District ITS is expected to help achieve Smooth Traffic, Safe Travel and Good Service for the transport development of the city. In order to evaluate the potential performance of the ITS, the ITS TA Specialists selected 9 indicators with 4 describing road traffic conditions and 5 describing public transport service level. The reason for choosing these specific indicators is that these indicators describe the levels of (i) transport safety, (ii) enforcement and emergency response, (iii) road smoothness, and (iv) attractiveness of services, which are the aspects directly correlated with the functions of ITS. Table 6 gives the current value of the 9 indicators considering the situations in Baiyin District. The 2020 objective values are also provided taking a comprehensive consideration of the Urban Master Plan development objectives, Urban Road Construction Plan development objectives, Transit Metropolis development objectives and the actual transport development trend of Baiyin District. As a great amount of factors will certainly influence the improvement of transport conditions, the construction and application of ITS is only a small part of the impact. Therefore, these values of performance evaluation indicators are for reference only.

Table 6: Performance evaluation indicators for Baiyin District ITS

Indicator	Current situation	2015 objective	2020 objective	2030 objective
Road Traffic				
01. Major traffic accident ratio	5.5%	5%	3%	Below 3%
02. Intelligent violation enforcement ratio	82%	85%	90%	Above 90%
03. Major urban area peak-hour vehicle speed (km/h)	34	32	30	30
04. Traffic incident average response time (min)	10-15	10	5	Below 5
Public Transport				
05. Bus ridership (excluding walk)	36.78%	39%	40-50%	Above 50%
06. Punctuality ratio	60%	65%	70-80%	Above 80%
07. Average peak-hour operating speed (km/h)	20	22	25	25
08. Passenger satisfaction ratio	82%	85%	90%	Above 90%
09. Bus-responsible traffic accident annual fatality ratio (person/10 thousand bus units)	4	3	0	0

5.3.3 Investment and Operating Cost Estimation

(i) Investment estimation

73. The investment estimation for current short-term ITS development has been worked out by LDI, and agreed by ADB and Baiyin PMO. The total investment estimation is **$5,207,569.34** with the traffic police's ITS accounting for $3,913,454.59 and the public transport ITS accounting for $1,294,114.75. Table 7 shows the detailed investment estimation for Baiyin District ITS.

Table 7: Investment estimation for Baiyin District ITS

Component	Investment Estimation in CNY	Investment Estimation in USD
Traffic Police ITS		
01. Operation Center	7,553,317.25	1,238,248.73
02. Signal Control	6,668,120	1,093,134.43
03. Electronic Police	2,869,539	470,416.23
04. Video Monitoring and Violation Recording	3,542,744	580,777.7
05. Traffic Guidance	3,097,960	507,862.3
Subtotal	**23,872,073**	**3,913,454.59**
Public Transport ITS		
01. Onboard Equipment	2,007,000	329,016.39
02. Stop and Depot Equipment	1,088,740	178,481.97
03. Operation Center	2,324,360	381,042.62
04. Software	2,374,000	389,180.33

Component	Investment Estimation in CNY	Investment Estimation in USD
05. System Installation Service	100,000	16,393.44
Subtotal	**7,894,100**	**1,294,114.75**
TOTAL	**31,766,173**	**5,207,569.34**

(ii) Operating cost estimation

74. Table 8 shows the operating cost estimation of Baiyin District ITS. Estimation is made based on Baiyin's local situation and previous project experience. There are 5 components considered in the estimation: (i) system operation power consumption, (ii) hardware and system maintenance, (iii) application software maintenance, (iv) data maintenance, and (v) dedicated network rental. Calculation bases and standards are listed in the table. The annual operating cost of Baiyin District ITS is **$408,739**, with $296,000 for traffic police and $112,739 for public transport, for the reference of the two implementation agencies.

Table 8: Annual operating cost estimation for Baiyin District ITS

Component	Calculation Basis and Standards	Cost Estimation in CNY	Cost Estimation in USD
Traffic Police ITS			
01. System operation power consumption	Design electricity usage [a.] * Unit price	200,000	32,787
02. Hardware and system maintenance	Equipment purchase costs * 5%	912,658	149,616
03. Application software maintenance	Application software installation costs * 5%	280,945	46,057
04. Data maintenance	Data processing costs [b.] * 5%	112,000	18,361
05. Dedicated network rental	Network service provider charges [c.]	300,000	49,180
Subtotal		**1,805,603**	**296,000**
Public Transport ITS			
01. System operation power consumption	Design electricity usage [a.] * Unit price	100,000	16,393
02. Hardware and system maintenance	Equipment purchase costs * 5%	276,005	45,247
03. Application software maintenance	Application software installation costs * 5%	118,700	19,459
04. Data maintenance	Data processing costs [b.] * 5%	43,000	7,049
05. Dedicated network rental	Network service provider charges [c.]	150,000	24,590
Subtotal		**687,705**	**112,739**
TOTAL		**2,493,308**	**408,739**

Note:
a. Estimated based on electricity cost data provided by implementation agencies;
b. Roughly calculated based on previous project data considering situations of this project;
c. Estimated based on network rental data provided by implementation agencies.

6 References

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[3] Baiyin Municipal Government. *Urban Road Construction Special Plan of Baiyin District 2012-2020*;
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SUPPLEMENTARY DOCUMENT 4
Poverty and Social Analysis

Contents

List of Tables

List of Figures

ABBREVIATIONS

ADB	-	Asian Development Bank
FGD	-	Focus Group Discussion
LIP	-	Liuchuan Industrial Park
MLS	-	Minimum Living Security
PMO	-	Project Management Office
WWTP	-	Wastewater Treatment Plant

Units

Currency unit	=	Yuan (CNY)
$1	=	CNY6.1
CNY1	=	$0.1639
1 hectare	=	15 mu

1 Background

1. Baiyin Municipality is located in the upper Yellow River and central Gansu Province, governing Baiyin District, Pingchuan District, Jingyuan County, Huining County and Jingtai County, with a land area of 21,200 km^2. Baiyin Municipality is a typical Chinese city established based on mines and enterprises, and one of the non-ferrous metal bases of the People's Republic of China (PRC). It has a complete non-ferrous metal industrial system that integrates geology, capital construction, mining, concentrating, smelting, processing and scientific research, and also an important energy and chemical base in Gansu Province and even northern China.

2. Over 50 years of continuous mining and development have depleted Baiyin Municipality's core mineral resources. By 2008, its copper ore resources could only meet 5% of smelting capacity, zinc ore resources could only meet 40% of smelting capacity, and lead ore resources could only meet 58% of smelting capacity. Most coalmines in the city had to close down due to resource depletion. With this background, Baiyin Municipality has dropped from the second to the fourth place in terms of regional GDP in Gansu Province, and its urban development faces a crisis of mineral resource depletion.

3. The industrial and financial crises arising from mineral resource depletion have resulted in the unemployment of numerous workers and a growing urban poor population. Baiyin Municipality's number of enterprise employees reached a peak of 210,000 in 1992, and dropped to 148,100 in 2004. In 2006, its urban unemployment rate was as high as 24%, ranking first among cities of the same type in Gansu Province and the PRC. It is estimated that the municipality's urban unemployment rate was 22.34% in 2012, ranking top among cities of the same type in Gansu Province and the PRC.

4. The longstanding economic pattern based on mineral resources and chemical smelting of Baiyin Municipality has resulted directly in serious environmental pollution and deterioration. According to the Urban Transformation Plan of Baiyin Municipality, atmospheric SO_2 levels in the urban area exceed the standard all year round, the annual industrial and domestic wastewater discharge is 39.15 million tons, and annual solid waste output is over 3 million tons.

5. In March 2008, Baiyin Municipality was identified as one of the first resource-depleted cities to be transformed in the PRC[①]. On this basis, the Gansu Provincial Government promulgated the Urban Transformation Plan of Baiyin Municipality (2010-2020) in 2010, positioning it as a regional economic growth center, an important city of new-type industry in western China, an important ecological barrier in central China, and a base for accepting relocation of industries.

6. On this basis, the Baiyin Municipal Government (BMG) has proposed a goal of accelerating city transformation to realize sustainable development, and subdivided this goal into economic, social, ecological and cultural transformation.

7. For economic transformation, traditional industries should be restructured, improved, and non-ferrous metal, new-type chemicals, composite energy sources, characteristic farm and animal products, and logistics and storage bases expanded. Industrial parks and bases, and development zones should be constructed to promote industry transformation and layout, and Lanzhou-Baiyin regional economic integration. These mainly include Baiyin National High-Tech Industrial Development Zone, Baiyin West Economic Development Zone, Baiyin District Startup Base for Small and Medium Enterprises, Pingchuan Central Economic Development Zone, Liuchuan Industrial Park (LIP), Huining County Agriculture Park, and Shangwosha Startup Base for Small and Medium Enterprises in Jingtai County.

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① http://www.baiyin.cn/Item.aspx?id=51098

8. For social transformation, such livelihood problems as employment, medical care, education, income, social security and housing should be solved properly to improve public service level. Vocational education development is a strategic priority, including establishing higher educational institutions, strengthening infrastructure construction for vocational education, driving the balanced development of different types of education, and strengthening reemployment skills training to improve employment and business startup capacity.

9. The Plan also proposes that infrastructure construction should be strengthened to lay a foundation for transformation, including highway and urban road network construction.

10. In this context, the Project is expected to promote the economic and social transformation strategy of Baiyin Municipality. The Project is located in the 23 km^2 planning area of LIP in Jingyuan County. LIP is one of the six major industrial parks of Baiyin Municipality, and will focus on the rare earth, non-ferrous metal, coal chemical, equipment manufacturing, storage, logistics and building material industries. The infrastructure to be constructed for LIP includes a trunk road, a water purification plant and an associated distribution network, and a WWTP and an associated sewer network.

11. To solve the employment or reemployment problem of laid-off workers, and rural surplus or semi-surplus labor in Baiyin Municipality, the economic transformation strategy proposes that vocational education and urban traffic infrastructure development should be priorities, which have been included in the Project.

12. The Project consists of four components, i.e., LIP Infrastructure, Technical and Vocational Education and Training, Intelligent Traffic System, and Institutional Capacity Building. The first component aims to generate job opportunities and reduce poverty; the second component aims to improve urban road traffic order and efficiency; the third component aims to provide skills training to employees for LIP.

13. LIP Infrastructure will need an estimated investment of $186.3 million, including a WWTP, a water purification plant and associated networks, and road construction. This component is part of all infrastructure of LIP yet plays a fundamental role.

14. The Intelligent Traffic System will need an estimated investment of $611,500, including a command center platform, a self-adapting signal control system, an e-police system, and a high-definition monitoring system, serving the built-up area of Baiyin District.

15. Technical and Vocational Education and Training and Institutional Capacity Building will need an estimated investment of $6.7277 million, including technical and vocational education and training, an environmental management system, institutional capacity building, etc. The technical and vocational education and training will be implemented by existing vocational schools in Baiyin Municipality and serve the municipality and surrounding areas.

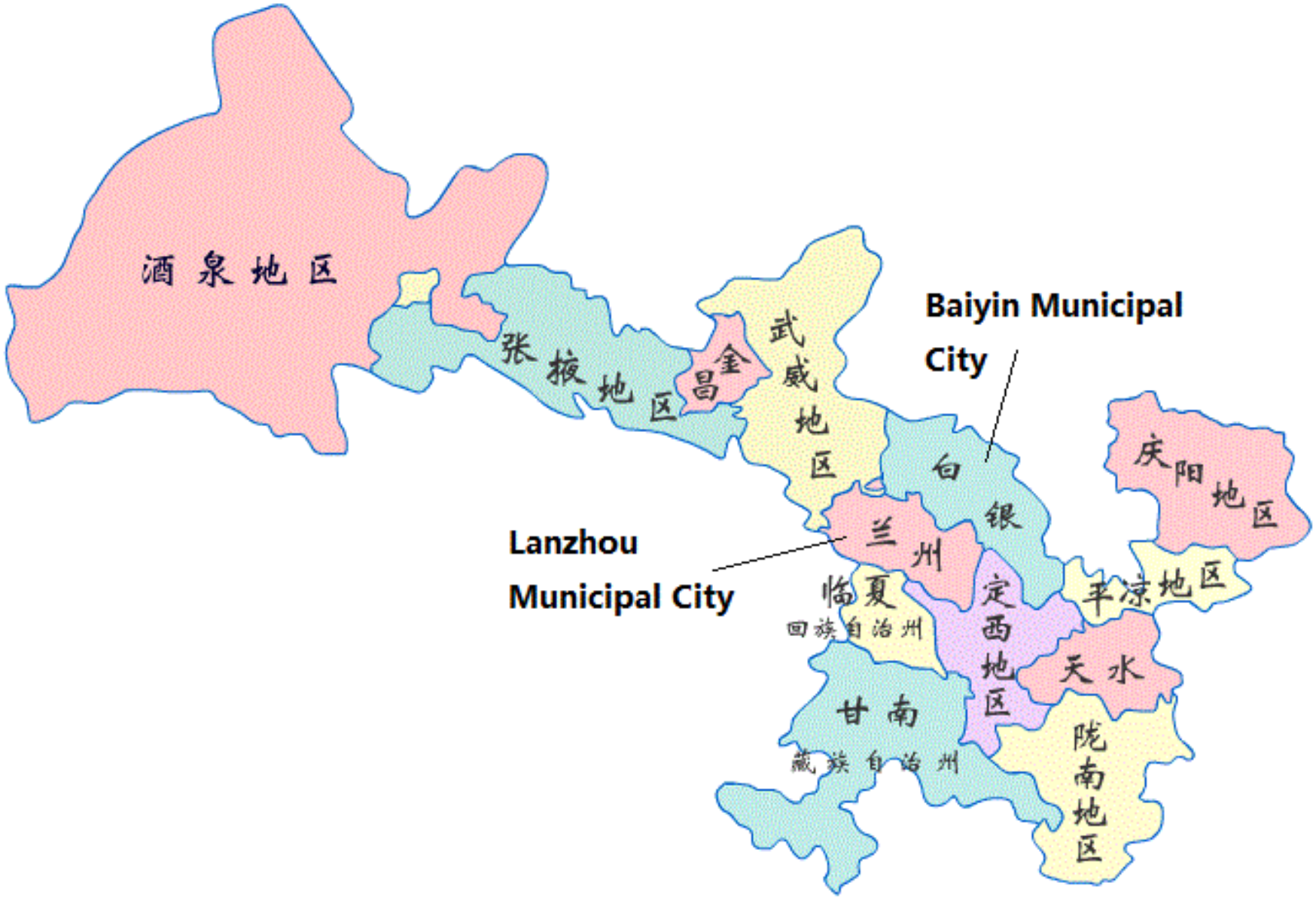

Figure 1: Location Map of the Project

Figure 2: Administrative Divisions of Baiyin Municipality

Figure 3: Location Map of LIP

注：（1）本图仅为项目示意图，并不作为项目设计的依据。（2）地图来自 Google 地图。 (1) this map just brief scope of the project; (2) map comes from Google map.

Figure 4: Schematic Layout of LIP Infrastructure Improvement

2 Rationale

16. Baiyin Municipality is surrounded by 4 provincial capitals (Lanzhou in Gansu, Xining in Qinghai, Yinchuan in Ningxia and Xi'an in Shaanxi), and located within the Lanzhou "one-hour economic circle", being the core part of the Lanzhou-Baiyin Economic Belt.

17. LIP is one of the six major industrial parks of Baiyin Municipality. The 23-km^2 project area is the core of the 50-km^2 medium-term planning area of LIP. LIP is located in Liuchuan Township in Jingyuan County, and over 80% of its planning area is composed of barren hills and sands, in which there are only two villages with a total population of 6,156.

18. The geographic advantages of LIP include:

(1) This area is a rare contiguous undeveloped barren hill area in Baiyin Municipality or even central Gansu, suitable for the intensive introduction of large and medium industrial enterprises.
(2) This area is run through by provincial and national highways, and railways, and is close to Lanzhou Zhongchuan Airport, enjoying great traffic advantages.
(3) This area is in close vicinity to the Yellow River, which provides plenty of water resources for industrial production.
(4) This area has a low population density and a low level of environmental sensitivity.
(5) Baiyin Municipality's existing industrial system based on non-ferrous metal, energy and chemical production is consistent with the positioning of LIP.
(6) Baiyin Municipality abounds with coal and wind power resources, and can provide plenty of energy to high-energy consumption industries.
(7) The large population of laid-off workers and rural surplus labor of Baiyin Municipality provides a stable labor supply to LIP.

19. The Project also complies with the state, provincial and municipal policies. Some Opinions of the State Council on Promoting the Sustainable Development of Resource-based Cities (SC [2007] No.38), and the Opinions of the Gansu Provincial Government on Supporting the Transformation of Baiyin Municipality (GPG [2008] No. 69) require that the sustainable economic and social development of Baiyin Municipality should be realized through industry transformation and restructuring. The Urban Transformation Plan of Baiyin Municipality (2010-2020) further defines this policy requirement. In addition, Some Opinions of the General Office of the State Council on Further Supporting the Economic and Social Development of Gansu Province (SCO [2010] No. 29) propose to support the development of the Lanzhou-Baiyin Economic Belt. The notice of the Gansu Provincial Government on Issuing the Transformation Plan for the Resource-depleted City of Baiyin (GPG [2010] No. 10) proposes more specific requirements for the economic and social transformation of Baiyin City. A leading group for the transformation of Baiyin City has been established under the provincial government to address difficulties and issues arising from transformation.

20. In addition, the Project will promote local economic and social development and poverty reduction by generating a large number of direct and indirect jobs, and offering vocational training.

21. The Project also complies with ADB's Country Partnership Strategy for China and the strategic goals for poverty reduction in the United Nations Millennium Campaign.

3 Methodology

22. The poverty and social analysis of the Project is conducted under the guiding framework on social development, gender, poverty reduction, ethnic minorities, resettlement, and public participation in ADB's Handbook on Social Analysis (2007) and Safeguard Policy Statement (2009).

23. The objectives of the poverty and social analysis are to:

(i) fully inform the local public, especially the urban unemployed and semi-unemployed population, and rural surplus labor, of basic project information freely through the public participation process;
(ii) investigate and learn the local socioeconomic profile, public needs and appeals, and the Project's potential social impacts and risks;
(iii) (evaluate the role of the Project in promoting local economic and social development, and poverty reduction, and improving livelihoods of the poor population;
(iv) evaluate the Project's potential impacts on ethnic minorities, women and other vulnerable groups, and how to promote their participation in the Project and improve their livelihoods; and
(v) propose an action plan based on the identified impacts and risks.

24. The methods and tools used in this analysis include: (1) literature review; (2) questionnaire survey; (3) FGD; (4) key informant interview; (5) stakeholder discussion and (6) rapid participatory appraisal.

25. **Literature review**: The following documents and literature were referred to:

(1) local development plans, such as the Outline of the Twelfth Five-Year Development Plan (12 FYP) of Baiyin Municipality, Master Development Plan of Baiyin Municipality, Urban Transformation Plan of Baiyin Municipality (2010-2020), 12 FYP of Jingyuan County, and LIP Development Plan (2013-2020);
(2) policies related to LIP development and construction, such as Some Opinions of the General Office of the State Council on Further Supporting the Economic and Social Development of Gansu Province;
(3) local socioeconomic statistics, such as the Statistical Yearbook of Gansu Province (past data), Statistical Yearbook of Baiyin Municipality (past data), National Economic Statistical Data of Jingyuan County (past data), National Economic and Social Development Statistical Bulletin of Baiyin Municipality (past data), National Economic and Social Development Statistical Bulletin of Jingyuan County (past data), Report on the Work of the Jingyuan County Government (past data); and
(4) local policies and statistics on civil affairs, social security, public health, ethnic minority development, women's development, etc.

26. **Questionnaire survey**: In the questionnaire survey, 433 copies of the questionnaire were distributed, with 400 valid copies recovered, accounting for 96.9%.

27. A mixed quota and snowball sampling method was used, mainly because:

(1) The subjects of the questionnaire survey are mainly unemployed, semi-unemployed and recessively unemployed persons, and rural surplus laborers, other than the public. Snowball sampling is the only choice for this sample population. It is a probability sampling method, in which an eligible sample is found and introduces another similar sample in turn, until the required sample size is reached. Meanwhile, in the process of snowball sampling, community leaders will support some basic information, such as sampling framework.

(2) The quota sampling method is used due to the limited duration, budget and sample size of the survey.

28. The subjects of the questionnaire survey mainly include: (1) urban and rural unemployed and semi-unemployed population, i.e., local surplus labor and (2) directly affected rural residents in the LIP planning area. The valid samples include 150 from Baiyin District, 100 from the Jingyuan county town, and 150 from rural areas around LIP. The geographic distribution of the valid samples is largely consistent with that of local surplus labor. Among the respondents, 191 are of rural status in household registration and 209 of urban status, accounting for 47.8% and 52.2% respectively.

29. 33.8% of the respondents are from Baiyin District, 58.5% from Jingyuan County, 4% from other provinces, and the other from the remainder of Baiyin Municipality. 10.3% of the respondents do not have registered residence in Baiyin Municipality. This shows that the sample population is composed of local residents mainly, and includes a small floating population.

30. 98.5% of the respondents are Han people and the other 1.5% Hui people; 83.8% of the respondents are married. 46% of the respondents are heads of households and 29.3% spouses of heads of households. 40.3% of the respondents are females. 36.8% of the respondents have received junior high school education, 43.5% have received senior high school or secondary technical school education, and 14% have received junior college or above education. The respondents range from 18 to 60 years, with an average age of 38.7 years and a standard deviation of 9.6 years.

31. Most of the respondents are unemployed or semi-unemployed labor. 20.8% of the respondents are covered by urban or rural MLS, and 26.4% think their families are poorest or poorer. 79.2% of the respondents are unemployed or semi-unemployed and 81.80% have been employed. Their current or past jobs include state-owned enterprise employees (16.3%), private enterprise employees (9%), self-employers (4.5%), jobbers (28.3%), farmers (24.8%), etc.

32. **FGD**: At least 25 focus group discussions (FGDs) were held in total, involving at least 255 participators, including urban and rural residents, the poor population, women, community workers, and heads of enterprises and public institutions.

33. In all FGDs, all interviews were related to components of this project, especially direct and indirect impacts from the component of LIP infrastructure construction to the project area and participators, and their attitude of the project, their skills status etc. The FGDs with Baiyin District's public and stakeholders are about their attitude to the ITS component, and their thinking about urban traffic status and problems. Some FGDs were held with female and the poor, from the poverty and gender perspectives.

Table 1: List of FGDs held in the social fieldwork

Time	Place	FGD	Number of participants
2014-1-3	Daxing Community, Baiyin District	1) Staff of community management committee	15
		2) Male community representatives	10
		3) Female community representatives	8
	Jianyin Community, Baiyin District	4) Staff of community management committee	11
		5) Male community representatives	11
		6) Female community representatives	8
2014-1-4	Nanchuan Village of Jingyuan County	7) Village representatives	22
		8) Village leaders	7
		9) Female villagers representatives	6
		10) Resettlement representatives	15
	Management committee of LIP	11) Representatives of LIP management committee staffs	5
		12) Representatives of enterprises in LIP	7

2014-1-5	Nanshanwei Village, Jingyuan County	13) Villager representatives	17
		14) Village leaders	6
		15) Female villager representatives	6
	Xintian village, Jingyuan County	16) Villager representatives	17
		17) Village leaders	7
2014-1-6	Xijie Community, Chengguan Township of Jingyuan County	18) Community citizen representatives	20
		19) Female community citizen representatives	10
		20) Staff of community management committee	6
	Civil Affairs Bureau of Jingyuan County	21) Jingyuan County governmental bureaus workshop	14
2014-1-7	Baiyin District	22) Representatives from TVET school	10
		23) Representatives of Baiyin traffic police station	6
		24) Workshops with Baiyin regional human resource and social security bureau	11
Total			255

34. **Stakeholder discussion**: 9 stakeholder discussions were held in total, including: (1) 4 with the PMO, executing agency and design agency; (2) two with government functional departments closely associated with the Project; and (3) 3 with enterprises, public institutions and communities affected by the Project.

35. **Data analysis**: Qualitative data were analyzed by induction and comparison, and quantitative data processed using SPSS19.0 and Microsoft Office Excel 2007.

4 Socioeconomic Profile of the Project Area

4.1 Definition of the Project Area

36. The Project (P46062) consists of four components, i.e.: (1) LIP Infrastructure; (2) Intelligent Traffic Management Systems; (3) Technical and Vocational Education and Training; and (4) Institutional Capacity Building. LIP Infrastructure is the core component, which will form part of all infrastructure of LIP, and will serve Jingyuan County, Baiyin Municipality and surrounding areas. Therefore, the direct beneficiary area of the Project is Jingyuan County, and its indirect beneficiary area includes Baiyin Municipality and surrounding areas.

37. Technical and Vocational Education and Training and Institutional Capacity Building will meet the labor demand of enterprises in LIP, promote the employment of urban unemployed and semi-unemployed labor, and rural surplus labor in Baiyin City and Jingyuan County effectively, and alleviate poverty.

38. Baiyin Intelligent Traffic Management Systems will improve the urban road traffic order and efficiency, regulate public traffic behavior, and raise public traffic safety awareness. This component is independent of the other components, and will be implemented in the urban area of Baiyin District only.

39. LIP is located in Liuchuan Township between the urban area of Baiyin City and the Jingyuan County town, and within Jingyuan County. However, it will benefit Jingyuan County as well as the whole of Baiyin Municipality. The Technical and Vocational Education and Training component will be implemented by the Jingyuan County Labor and Social Security Bureau, and benefit Jingyuan County mainly, as well as the whole of Baiyin Municipality.

40. In summary, the project area is defined as (1) Jingyuan County, the core project area; and (2) Baiyin Municipality, the beneficiary area.

4.2 Administrative Divisions and Natural Conditions

41. Baiyin Municipality has a land area of 21,200 km^2, and governs Baiyin District, Pingchuan District, Jingyuan County, Huining County and Jingtai County, 69 townships, 9 sub-districts, 91 communities and 701 villages. Baiyin District directly affected by the Project is the main urban area of Baiyin Municipality, governing 5 townships, 5 sub-districts, 35 communities and 45 villages, with a land area of 1,372 km^2; Jingyuan County directly affected by the Project governs 18 townships, 10 communities and 174 villages, with a land area of 5,789.8 km^2.

42. Baiyin City is located in an extremely dry region in northwestern China, in close vicinity to the Tenger Desert, featuring distinct seasons and low rainfall, with an average annual precipitation of about 200 mm and an average annual evaporation of about 2,000 mm.

43. At the end of 2012, the municipality's water supply rate was 99.56%, those of Baiyin and Pingchuan Districts were 100%, that of Jingyuan County 99.89%, that of Huining County 97.93% and that of Jingtai County 99.33%. Although full water supply coverage has been realized in the municipality, the per capita water consumption varies a lot from place to place. The per capita daily domestic water consumption ranges from 252.38 liters/person-day (Pingchuan District) to 40.44 liters/person-day (Huining County), averaging 142.48 liters/person-day.

4.3 Economic Conditions

44. Baiyin Municipality is an important industrial city of Gansu Province and plays an important role in the province's economy. In 2012, the GDP of Gansu Province was CNY565.02 billion and that of Baiyin Municipality CNY43.377 billion, accounting for 7.68% of the provincial

total, ranking 4th among the 14 prefecture-level cities of the province. In 2012, the added value of primary industries of Baiyin Municipality was CNY4.858 billion, that of secondary industries CNY24.86 billion and that of tertiary industries CNY13.659 billion, accounting for 11.2%, 57.3% and 31.5% respectively, while the percentages of primary, secondary and tertiary industries of Gansu Province were 13.8%, 46.0% and 40.2% respectively. This shows that though Baiyin Municipality faces an industrial crisis due to resource depletion, the percentage of secondary industries is still much higher than the provincial average.

45. In 2012, Gansu Province's per capita GDP was CNY21,978 and that of Baiyin Municipality CNY25,274, ranking 5th in the province. Gansu Province's per capita disposable income of urban residents was CNY17,157 and that of Baiyin Municipality CNY18,532, ranking 4th in the province. Gansu Province's per capita net income of farmers was CNY4,507 and that of Baiyin Municipality 4,497, ranking 7th in the province. Gansu Province's fiscal revenue was CNY108.038 billion and that of Baiyin Municipality 5.586 billion, ranking 5th in the province. Gansu Province's grain output was 11.09 million tons and that of Baiyin Municipality 721,300 tons, ranking 8th in the province. Gansu Province's balance of savings deposits of urban and rural residents was CNY505.008 billion and that of Baiyin Municipality 26.015 billion, ranking 9th in the province. In 2012, the Engel's coefficient of urban households of Baiyin Municipality was 35.95% and that of rural households 45.18%, while the provincial averages were 35.82% and 39.8% respectively.

46. Based on comparison, Baiyin Municipality is above the provincial average in terms of economic and social development, as indicated by urban and rural residents' income levels.

47. The districts and counties of Baiyin Municipality vary greatly in economic and social development level. In 2012, fiscal revenue ranged from CNY561.08 million (Jingyuan County) to CNY93.44 million (Huining County), and per capita fiscal revenue ranged from CNY1,882.1 (Baiyin District) to CNY165.64 (Huining County).

48. In 2012, Baiyin Municipality's per capita net income of farmers was CNY4,497, ranging from CNY7,461 (Baiyin District) to CNY3,515 (Huining County), while the provincial average was CNY4,506.7 and the national average CNY7,917. Per capita cultivated area was 3.42 mu, ranging from 4.15 mu (Huining County) to 1.94 mu (Baiyin District).

49. Huining County with the lowest per capita net income of farmers has the largest per capita cultivated area, showing that farmers' income is not directly related to cultivated area. The survey shows that the key factors contributing to farmers' income include irrigation, commercial crop cultivation and nonagricultural income.

Table 2: Economic Indicators of the Project Area (2012)

	Gross population (0,000)	Rural population (0,000)	GDP		Per capita disposable income of urban residents (CNY)	Per capita net income of farmers (CNY)	Cultivated area (0,000 mu)	Per capita cultivated area (mu)	Sown area (0,000 mu)	Percent of cultivated area (%)
			Total (CNY 00 million)	Per capita (CNY)						
PRC	135404	64222	519322	38,355	21,986	7,917	182489	2.84	166905	91.46
Gansu Province	2577.55	1578.75	5650.2	21,921	17,157	4,507	16702	10.58	4259	25.5
Baiyin Municipality	174.30	133.74	433.77	25,274	18,532	4,497	456.85	3.42	359.25	78.64
Baiyin District	27.65	6.91	211.9	76,637	19,442	7,461	13.43	1.94	6.94	51.68
Pingchuan District	20.08	9.96	65.1	32,420	15,787	4,822	26.36	2.65	20.48	77.69
Jingyuan County	46.99	43.79	54.41	11,579	12,980	4,836	116.7	2.66	80.13	68.66
Huining County	56.41	54.53	45.94	8,144	10,816	3,515	226.06	4.15	209.31	92.59
Jingtai County	23.17	18.55	49.25	21,256	12,793	5,238	74.3	4.01	42.39	57.05

Source: Statistical Yearbook 2013 of China, Statistical Yearbook 2013 of Gansu Province, Statistical Yearbook 2013 of Baiyin Municipality

50. The townships of Jingyuan County vary greatly in economic and social development level. For example, in 2011, the county's per capita net income of farmers was CNY4,108, ranging from CNY5,050 (Wulan Town) to CNY2,090 (Ruoli Township). Among all townships, 3 townships are above CNY5,000 and 5 townships below CNY3,000. A basic rule is that townships with excellent irrigation facilities are richer.

Table 3: Statistics of Per Capita Net Income (CNY) of Farmers in Jingyuan County (2011)

Division	Per capita net income of farmers	Division	Per capita net income of farmers	Division	Per capita net income of farmers
County average	4,108	**Liuchuan Township**	4,345	Shimen Township	2,790
Wulan Town	5,050	Dongsheng Township	4,135	Xinglong Township	2,760
Dongwan Town	5,000	Beitan Township	4,085	Shuanglong Township	2,740
Beiwan Town	5,000	Wuhe Township	4,070	Yongxin Township	2,290
Pingbao Township	4,750	Jing'an Township	3,535	Ruoli Township	2,090
Santan Township	4,700	Dalu Township	3,525		
Mitan Township	4,630	Gaowan Township	3,280		

Source: National Economic Statistical Data of Jingyuan County (2011)

4.4 Population and Employment

51. At the end of 2012, Gansu Province had a resident population of 25.7755 million, including an urban population of 9.988 million, accounting for 38.75%; and a rural population of 15.7875 million, accounting for 61.25%. By age, the population aged 0-14 years was 4.4489 million, accounting for 17.26%; the population aged 15-64 years 19.1589 million, accounting for 74.33%; and the population aged 65 years or more 2.1677 million, accounting for 8.41%. By gender, the male population was 13.1687 million, accounting for 51.09%; and the female population 12.6068 million, accounting for 48.91%.

52. At the end of 2012, Baiyin Municipality had a resident population of 1.7192 million, accounting for 6.67% of the provincial resident population, including an urban population of 714,200 and a rural population 1.005 million, accounting for 41.54% and 58.46% respectively. In 2012, the municipality's registered population was 1.743 million, 23,800 more than the resident population, indicating a net population outflow of 23,800. Compared to 2011, the agricultural population of 2012 dropped sharply by 60,800, while the nonagricultural employed population rose by 9,400 only, indicating a significant population outflow in the past two years, and the main part of this population outflow was the urban registered population.

Table 4: Population of Baiyin Municipality (0,000)

Year	Total	Gender		Type of population		Household registration	
		Male	Female	Agricultural	Nonagricultural	Rural	Urban
2000	172.09	89.56	82.53	136	36.09	135.07	37.02
2001	172.89	89.76	83.13	135.61	37.28	135.77	37.12
2002	173.44	90.14	83.3	135.21	38.23	136.12	37.32
2003	173.64	90.07	83.57	134.42	39.22	136.14	37.5
2004	174.58	90.65	83.93	134.07	40.51	136.37	38.21
2005	174.57	90.52	83.97	132.96	41.61	136.67	37.9
2006	174.54	91.34	84.02	131.89	42.65	136.54	38
2007	176.33	91.34	54.99	132.28	44.05	135.39	40.94
2008	178.06	92.26	85.8	132.79	45.27	135.29	42.77
2009	179.55	92.98	86.57	133.17	46.38	135.17	44.38
2010	180.39	93.32	87.08	132.87	47.52	134.47	45.92
2011	179.43	92.61	86.82	132.35	47.08	133.94	45.49
2012	174.3	90.24	84.06	126.27	48.02	133.74	40.56

Source: Statistical Yearbook 2013 of Baiyin Municipality

53. Jingyuan County has the second largest population among the districts and counties of Baiyin Municipality, with a registered population of 469,900 in 2012, second only to Huining

County. By gender, the male population is 241,200 and female population 228,700, accounting for 51.33% and 48.67% respectively; by employment, the agricultural population was 415,000 and nonagricultural population 55,000, accounting for 11.67% and 88.33% respectively. In 2012, the county's population inflow was 7,649 and population outflow 21,757.

54. Among the 18 townships of Jingyuan County, six townships have populations of over 30,000, in which Liuchuan Township (where LIP is located) had a population of 32,721, including a nonagricultural population of 1,549 only, at the end of 2011.

Table 5: Population Distribution of Jingyuan County in 2011

	Number of households	Population			Nonagricultural population
		Total	Male	Female	
Total	**172,298**	**481,100**	**246,061**	**235,039**	**54,905**
Wulan Town	23,902	69,639	35,623	34,016	34,581
Beitan Township	12,522	44,677	22,793	21,884	1,662
Dongwan Town	12,144	42,886	21,613	21,273	2,994
Beiwan Town	11,207	39,830	20,333	19,497	2,116
Wuhe Township	9,070	33,733	17,164	16,569	1,220
Liuchuan Township	**8,973**	**32,721**	**16,813**	**15,908**	**1,549**
Gaowan Township	27,391	27,548	14,307	13,241	1,056
Dongsheng Township	6,493	25,225	12,871	12,354	912
Mitan Township	6,714	24,852	12,711	12,141	1,293
Santan Township	6,444	22,122	11,237	10,885	1,482
Dalu Township	5,923	21,135	10,661	10,474	1,314
Pingbao Township	18,682	18,962	9,869	9,093	1,195
Shimen Township	4,490	15,592	8,069	7,523	801
Shuanglong Township	3,991	15,252	7,852	7,400	611
Jing'an Township	4,349	13,671	6,981	6,690	513
Xinglong Township	3,899	12,977	6,578	6,399	689
Yongxin Township	3,112	10,630	5,530	5,100	439
Ruoli Township	2,965	9,648	5,056	4,592	478

Source: National Economic Statistical Data of Jingyuan County (2011)

55. In 2012, Baiyin Municipality's rural labor force[①] was 832,600, including 711,200 rural employees, 62,500 students aged 16 years or above, 45,900 house-workers, and 13,000 other laborers[②]; the urban labor force was 308,800, including 239,800 urban employees (77.66%), and unemployed or semi-unemployed urban laborers accounted for 22.34%.

56. In Baiyin District, the rural population accounts for 25.04% and urban population accounts for 74.96%. The rural labor force is 41,800, and urban labor force is 157,900, including an urban employed population of 122,600, and 35,300 unemployed or semi-unemployed laborers, consistent with the data provided by the Baiyin Municipal Labor and Social Security Bureau.

57. In Jingyuan County, the rural population accounts for 93.19% and urban population accounts for 6.81%. Among its rural population, the rural labor force is 262,300, and urban labor force 24,400, including 7,600 urban unemployed or semi-unemployed laborers.

Table 6: Population and Labor Distribution of Jingyuan County in 2012

	Baiyin Municipality	Baiyin District	Pingchuan District	Jingyuan County	Huining County	Jingtai County
Gross population (0,000)	174.30	27.65	20.08	46.99	56.41	23.17
Rural population (0,000)	133.74	6.91	9.96	43.79	54.53	18.55
#Rural labor force	83.26	4.18	6.17	26.23	33.98	12.70

① Labor force refers to laborers of labor age (16 years or above) having the ability to work.
② These usually include persons without the ability to work due to disability, illness, etc.

- Rural employed population	71.12	3.42	5.22	22.41	29.34	10.73
- Students aged 16 years or above	6.25	0.36	0.39	1.96	2.70	0.84
- House-workers	4.59	0.28	0.43	1.21	1.68	0.99
- Other	1.30	0.12	0.13	0.65	0.26	0.14
Urban population	40.56	20.74	10.12	3.20	1.88	4.62
#Urban labor force[①]	[②]*30.88*	*15.79*	*7.70*	*2.44*	*1.43*	*3.52*
- Urban employed population	[③]23.98	*12.26*	*5.98*	*1.89*	*1.11*	*2.73*
- Urban organizational employees[④]	15.32	*6.29*	*4.10*	*1.69*	*1.81*	*1.45*
- Active workforce[⑤]	14.72	6.04	3.94	1.62	1.74	1.39

Source: Statistical Yearbook 2013 of Baiyin City

58. The overall quality of the labor force in the project area is high. 63.86% of rural employees have received junior high school or above education, and over 90% of young employees have received junior high school or above education. 56,200 rural employees work elsewhere, accounting for rural employees 7.9%, and most rural employees work locally.

Table 7: Statistics and Distribution of Rural Employees in Baiyin Municipality (2012)

		Baiyin Municipality	Baiyin District	Pingchuan District	Jingyuan County	Huining County	Jingtai County
Total of rural employees		71.12	3.42	5.22	22.41	29.34	10.73
Gender	Male	36.78	1.84	2.71	11.59	15.09	5.55
	Male	34.34	1.58	2.51	10.82	14.25	5.18
Educational level	Senior high school or above	15.21	1.27	1.20	4.58	5.93	2.23
	Junior high school	30.21	1.33	2.09	10.06	12.24	4.49
	Primary school	23.06	0.79	1.57	7.63	9.34	3.73
	Illiterate or semiliterate	2.64	0.03	0.36	0.14	1.83	0.28
Place of work	Local	65.50	3.23	4.91	21.17	25.78	10.41
	Non-local	5.62	0.19	0.31	1.24	3.56	0.32

Source: Statistical Yearbook 2013 of Baiyin City

Table 8: Summary of Urban and Rural Unemployment Rates in the Project Area (2012)

	Baiyin Municipality	Jingyuan County
Urban labor force (0,000)	30.88	2.44
Urban unemployed labor force (0,000)	6.9	0.55
Urban unemployment rate (%)	22.34%	22.54%
Rural labor force (0,000)	83.26	26.23
Rural unemployed labor force (0,000)	12.14	3.82
Rural unemployment rate (%)	14.58%	14.56%
Gross labor force (0,000)	114.14	28.67
Gross unemployed labor force (0,000)	19.04	4.37
Overall unemployment rate (%)	16.68%	15.24%

Note: The unemployed labor here includes semi-unemployed labor but excludes recessively unemployed labor. The data is from the Statistical Yearbook 2013 of Baiyin Municipality mainly.

4.5 Education

[①]The urban labor force data of the districts and counties is estimated from the percentage of urban labor force to urban population.
[②]This data is calculated the percentage of urban labor force to urban population.
[③] "Urban employees" refer to all persons working in a paid manner in urban areas.
[④] "Urban organizational employees" refer to all persons working in a paid manner at state organs, government agencies, social organizations, public institutions and urban enterprises (source: Statistical Yearbook 2013 of Baiyin Municipality).
[⑤] "Active workforce" includes employees working in a paid manner at the time of the survey, including contracted or registered employees, and those on study tours or on leave while still being paid (source: Statistical Yearbook 2013 of Baiyin Municipality).

59. The overall situation of education in Baiyin City is that primary education is good, but vocational and higher education is weak.

60. At the end of 2011, Baiyin City had 115 kindergartens and 716 primary schools, and the enrollment rate of school-age children was 100%. The numbers of kindergartens and primary schools ranked fifth and second among all prefecture-level cities of the province respectively. The ranking of Baiyin Municipality in the province in terms of primary education is almost consistent with the ranking of its population.

61. In 2011, there were 133 regular high schools[①], 64,857 high school graduates, 175,173 students and 11,348 full-time teachers in Baiyin City, ranking 2nd, 3rd, 3rd and 3rd among all prefecture-level cities of the province respectively, reflecting that Baiyin City's overall level of secondary education is good. There is only one college in the city, with 161 full-time teachers and 1,340 students. Compared to primary education, higher education is weak in Baiyin Municipality.

62. At the end of 2012, Baiyin Municipality had three secondary technical schools, with 342 full-time teachers and 8,520 students. In 2012, 26,440 students were enrolled by colleges and universities, and 6,637 by secondary technical schools, accounting for 79.93% and 20.07% respectively.

63. In terms of the numbers of primary schools, students and full-time teachers, the development of primary education among different districts and counties of Baiyin City is largely balanced and consistent with the population.

Table 9: Primary and High School Education in Baiyin Municipality (2012)

	Baiyin Municipality	Baiyin District	Pingchuan District	Jingyuan County	Huining County	Jingtai County
1. Number of schools	954	66	93	254	400	141
1.1 Regular high schools	153	19	22	40	52	20
# Complete high schools	6	3	2	0	1	0
Senior high schools	22	7	2	5	5	3
Junior high schools	111	7	10	33	46	15
Nine-year schools	13	1	8	2	0	2
12-year schools	1	1	0	0	0	0
1.2 Primary schools	801	47	71	214	348	121
2. Number of students	289,883	45,577	33,847	73,605	101,153	35,701
2.1 Regular high schools	160,858	25,029	18,474	43,060	54,979	19,316
#Senior high schools	64,349	11,349	7,062	16,791	20,233	8,914
Junior high schools	96,509	13,680	11,412	26,269	34,746	10,402
2.2 Primary schools	129,025	20,548	15,373	30,545	46,174	16,385
3. Full-time teachers	22,338	3,099	2,946	5,974	7,200	3,089
#Senior high schools	3,995	785	591	975	1,124	520
Junior high schools	7,644	828	1,113	2,039	2,633	1,001
Primary schools	10,699	1,486	1,242	2,960	3,443	1,568

Source: Statistical Yearbook 2013 of Baiyin Municipality

[①] This number (133) is from the Statistical Yearbook 2012 of Gansu Province, differing from the number (165) from the Statistical Yearbook 2013 of Baiyin Municipality. The former is used here.

5 Stakeholder Analysis

64. The Project builds the core infrastructure of LIP and is essential to the development of LIP. On this basis, the Project's primary stakeholders have been identified to be:

(1) urban unemployed and semi-unemployed population in the urban area of Baiyin Municipality and Jingyuan County;
(2) rural surplus labor in areas around LIP;
(3) farmers within the directly affected area of LIP;
(4) enterprises in LIP, including existing and future enterprises and those under construction; and
(5) others.

5.1 Public Participation and Consultation

65. As of the time of the survey, preparation for LIP construction had lasted at least 4 years. In this period, the Baiyin Municipal and Jingyuan County Governments, and local mass media conducted extensive reportage and publicity. As a result, the public awareness of the Project is very high. The questionnaire survey shows that 86% of the respondents are aware of the Project; 45.9% have heard of it from reporting and publicity on TV, broadcast, newspapers, magazines and other local mass media, 20.8% from relatives and friends, 19.7% from government publicity, and a few others from village or community committee publicity or personal visit.

66. In a search for the keyword "LIP" (in Chinese) on the search engine of baidu.com, 4.17 million links were found. This is sufficient to show the extensiveness of publicity and public participation at the preparation stage.


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67. The socioeconomic survey is an integral part of public participation at the preparation stage. During the survey, the survey team conducted FGDs and key informant interviews to collect public opinions, expectations, attitudes and suggestions. This will be described in Section 5.2 in detail.

68. According to the questionnaire survey, 49.6% of the respondents think the Project is important or very important to their families, and 9.8% think it is unimportant. 81.8% of the respondents support the Project, 17.3% do not support it or do not care, and only 1% is unaware of the Project. 45.1% of the respondents think the most important positive impact of the Project for their families is improving the living environment, and 38.8% think this is offering job opportunities. In addition, 33% of the respondents think the Project will not have any negative impact on their families, and 35.6% think construction will result in environmental pollution and other negative impact. The results of the survey will be described in detail in other parts of this report.

5.2 Primary Stakeholders

5.2.1 Urban and rural surplus labor

(1) Urban unemployed or semi-unemployed population

69. Baiyin Municipality is an old industrial base and one of the first resource-depleted cities to be transformed in the PRC, with a large urban unemployed or semi-unemployed population. In 2012, Baiyin Municipality's urban labor force was 308,800, including 239,800 urban employees (77.66%), and unemployed or semi-unemployed urban laborers accounted for 22.34%.

70. The urban unemployed or semi-unemployed labor of Baiyin City is located mainly in Baiyin District, followed by Pingchuan District and Jingyuan County. This population is generally divided into the following types:

(1) laid-off workers during the reorganization of large and medium state-owned enterprise;
(2) laid-off workers during the reorganization of state-owned or collective enterprises;
(3) laid-off workers or unemployed laborers working at individual and private enterprises;
(4) rural laborers going to town and not employed yet, such as rural migrants resettled in town due to land acquisition or house demolition; and
(5) fresh graduates.

71. Among the above types of urban unemployed or semi-unemployed population, the first type accounts for about 70%, i.e., about 50,000; the second type accounts for about 10%, i.e., 7,000; the other 3 types are relatively minor. Among the five types, the unemployed or semi-unemployed population of the former two types is usually elderly, mostly aged 35-50 years.

72. A special type of urban labor force is laborers taking care of family members, especially housewives taking care of children, with an estimated population of about 15,000. Their labor and employment is highly flexible. When expected income is high, they are able to obtain employment.

73. Except the above urban unemployed or semi-unemployed population, another group that may work in LIP is recessively unemployed population, which is characterized by inadequate employment and significantly affected income. This group is often found at large and medium state-owned enterprises, mainly because such enterprises have suspended or partly suspended production extensively and continuously due to successful reorganization, low technology level or high production costs. Since the industrial positioning of LIP is close to the traditional industrial structure of Baiyin Municipality, this group is most likely to work at new enterprises in LIP, with an estimated population of over 20,000.

74. In summary, Baiyin Municipality's urban semi-unemployed or unemployed labor force is 69,000, and recessively unemployed labor force 20,000, totaling 89,000, accounting for 28.8% of the urban labor force.

(2) Rural surplus labor

75. The main agricultural patterns of Baiyin City are:

(1) greenhouse vegetable cultivation + food crop cultivation in plains along the Yellow River;
(2) fruit tree cultivation + food crop cultivation in hilly areas along the Yellow River;
(3) household stockbreeding + food crop cultivation + vegetable cultivation in hilly areas far away from the Yellow River with artificial irrigation; and
(4) food crop cultivation in desert areas far away from the Yellow River with artificial irrigation.

76. Since different agricultural patterns have different labor requirements, the percentage of rural surplus labor varies from area to area. In Type Four areas, over 50% of rural laborers work outside, especially young adult laborers (over 70%). In areas of the other three types, the percentage of rural surplus labor is high, but the percentage of young adult laborers working outside is still high, usually above 60%.

77. Baiyin Municipality has a rural population of 1.3374 million, including a rural labor force of 832,600, including 712,200 rural employees. Among rural employees, 56,200 work elsewhere, and 508,300 work on farming, forestry, fishery or stockbreeding. However, according to the data of the Baiyin Municipal Labor and Social Security Bureau, the rural labor force working purely on agricultural production does not exceed 300,000, that working on both agricultural and nonagricultural production is about 300,000, and that working purely on nonagricultural production is about 110,000. For the rural labor force, the surplus labor is estimated to be about 120,000, accounting for 14.4%.

(3) Main features and needs of urban and rural surplus labor

78. The subjects of the questionnaire survey are the urban unemployed or semi-unemployed population. 94.7% of the respondents have been employed before, and only 5.3% have never been employed. Among those who have been employed before, 66.5% have worked in the urban area of Baiyin Municipality, 28.9% in the remainder of Baiyin Municipality, and only 4.5% in other parts of Gansu Province or out of the province. Urban unemployed or semi-unemployed

population is mainly from the local employment market of Baiyin Municipality, and most of them expect to be reemployed on the local employment market.

79. 67.5% of the rural respondents have been employed before, and 32.5% have been doing farm work or other labor. Among those who have been employed before, 40.3% have worked in the urban area of Baiyin Municipality, 52.7% in the remainder of Baiyin Municipality, and 7% in other parts of Gansu Province or out of the province. This shows that the rural surplus labor is employed locally mainly, and rarely works elsewhere. This feature is similar to that of the urban unemployed or semi-unemployed population, and shows that the local surplus labor flow is inactive.

Table 10: Employment Experience

	Yes	No
Rural	32.5%	67.5%
Urban	5.3%	94.7%
Total	18.3%	81.8%

Table 11: Places of Most Recent Jobs

	Urban area of Baiyin Municipality	Remainder of Baiyin Municipality	Remainder of the province	Out of the province
Rural	40.3%	52.7%	3.1%	3.9%
Urban	66.5%	28.9%	2.5%	2%
Total	56.1%	38.3%	2.8%	2.8%

80. The above data show that although there is a large urban and rural surplus labor force in the project area, its basic feature is prefers local reemployment, thereby providing an important potential labor force to the Project objectively. This feature is also shown clearly in the survey data, where 49.3% of the respondents wish to work in the county, 40.2% wish to work in the remainder of Baiyin Municipality, and only 1% wish to work out of the province.

Table 12: Expected Places of Employment

	In the county	Remainder of Baiyin Municipality	Lanzhou Municipality	Remainder of the province	Out of the province	Do not care
Rural	63.7%	23.1%	1.1%	1.1%	0%	11%
Urban	36.3%	55.7%	2.5%	1%	0%	4.5%
Total	49.3%	40.2%	1.8%	1%	0%	7.6%

81. Among primary causes of unemployment or semi-unemployment, 24.5% of the respondents choose low pay, 22.6% choose staff reduction or closedown, 15.2% choose having to take care of family members (old people or children), and other causes include physical health, incompetence, etc. Among secondary causes of unemployment or semi-unemployment, 35.1% choose low pay, and 17.5% want to find a new job and have a better working environment. Among tertiary factors of unemployment or semi-unemployment, job change due to a bad working environment is the most important factor. This shows that pay level and the working environment are the primary causes of unemployment or semi-unemployment.

Table 13: Causes of Unemployment

	Primary cause (%)	Secondary cause (%)
Physical health	9	8.1
Incompetence	9.2	6.6
Staff reduction or closedown	22.6	8.5
Having to take care of family members	15.2	11.8
Low pay	24.5	35.1
Wanting to find a new job	5.4	17.5
Wanting to rest for some time	1.9	8.5
Other	12.2	3.8

Total	100	100

82. Similarly, among primary concerns about reemployment, 83.2% of the respondents are most concerned about pay and benefit level, and 6.5% are concerned about hazards. Among secondary concerns about reemployment, 40% are concerned about the availability of social insurance, and 28% about hazards. Concern of the distance from the workplace to the home is in the 3rd place.

Table 14: Greatest Concern about Reemployment

	Primary factor			Secondary factor		
	Rural	Urban	Total	Rural	Urban	Total
Pay and benefit level	85.9%	80.7%	83.2%	2.9%	2.6%	2.8%
Hazards	3.8%	8.9%	6.5%	43.3%	14.2%	28%
Distance from home	3.3%	3.5%	3.4%	12.3%	11.1%	11.6%
Overtime	0.5%	1.5%	1%	1.2%	4.7%	3%
Social insurance	1.1%	4%	2.6%	26.3%	52.1%	39.9%
Personal interest	0%	1%	0.5%	2.9%	1.1%	1.9%
Learning new skills	3.3%	0%	1.6%	1.2%	4.7%	3%
Development prospect	2.2%	0.5%	1.3%	9.4%	8.9%	9.1%
Making new friends	0%	0%	0%	0.6%	0.5%	0.6%
Total	100%	100%	100%	100%	100%	100%

83. 47.7% of the respondents expect a pay of CNY2,001-3,000, 29.5% expect CNY3,001-4,000, 10.1% expect CNY1,001-2,000, and only 12.4% expect over CNY4,000. The Statistical Yearbook 2013 of Baiyin Municipality shows that in 2012, the average annual pay of employees in Baiyin Municipality was CNY44,866. This means that the overall expected pay level of the respondents is equivalent to the average monthly pay of employees in Baiyin Municipality.

Table 15: Expected Monthly Pay for Reemployment

	Rural	Urban	Total
CNY1,001-2,000	5.4%	14.4%	10.1%
CNY2,001-3,000	44.6%	50.5%	47.7%
CNY3,001-4,000	33.7%	26.2%	29.8%
CNY4,001-5,000	9.8%	6.4%	8%
CNY5,001-6,000	5.4%	2%	3.6%
CNY6,001-7,000	1.1%	0%	0.5%
CNY7,001 or above	0%	0.5%	0.3%

84. 34.4% of the respondents have durations of unemployment or semi-unemployment of not more than 3 months, 18.7% not more than half a year, 9.5% not more than a year, and 37.4% more than a year. This shows that the local surplus labor has short durations of unemployment or semi-unemployment in general, and most laborers can be reemployed shortly. However, 52.3% of rural surplus labor has durations of unemployment of over a year, while this percentage is only 24.4% for urban unemployed or semi-unemployed population. This shows tha, urban unemployed or semi-unemployed population has more reemployment opportunities than rural surplus labor.

Table 16: Duration of Most Recent Unemployment

	Within 3 months	Within half a year	Within one year	One year or more
Rural	31.4%	7.6%	8.7%	52.3%
Urban	37.1%	28.4%	10.2%	24.4%
Total	34.4%	18.7%	9.5%	37.4%

85. Those unemployed or semi-unemployed do not do nothing during unemployment. 31% of the unemployed or semi-unemployed respondents do odd jobs occasionally, 17.4% find a new job, and 16.8% do farm work and 15.2% take care of family members. However, only 2.4%

of the unemployed or semi-unemployed respondents learn new skills and knowledge during unemployment or semi-unemployment.

Table 17: Main Activities during Unemployment

	Rural	Urban	Total
Doing nothing at home	9.8%	11.9%	10.9%
Doing odd jobs occasionally	17.2%	43.3%	31%
Taking care of family members	17.8%	12.9%	15.2%
Doing farm work	29.9%	5.2%	16.8%
Finding a new job	9.2%	24.7%	17.4%
Learning new skills and knowledge	2.9%	2.1%	2.4%
Other	13.2%	0%	6.3%

86. 70% of the unemployed or semi-unemployed respondents will be reemployed, 23% will depend, and only 7% will not be reemployed. 12.4% of the rural unemployed or semi-unemployed respondents will not be reemployed, much higher than the percentage of the urban counterparts of 2%. This shows that though over 15% of the unemployed or semi-unemployed respondents are not employed for taking care of family members, most of them will be reemployed as long as they can find a suitable job.

Table 18: Will you be reemployed?

	Yes	No	Unclear
Rural	60.7%	12.4%	27%
Urban	78.3%	2%	19.7%
Total	69.9%	6.9%	23.1%

5.2.2 Farmers in LIP

87. Two villages (Nanchuan and Nanshanwei Villages) with a total population of 6,156 in the LIP planning area will be affected directly by land acquisition and house demolition, and will be relocated in the service area of the Project.

88. In the LIP planning area, most residents migrated from nearby desert areas in Huining and Jingtai Counties because the Liuchuan irrigation area serviced by the Yellow River was completed in the late 1970s, which provides basic conditions for agricultural production in this area.

89. Although this area has a dry climate, it is a relatively developed area in local rural areas, which is attributed to the local agricultural pattern of sheep raising + vegetable cultivation + food crop cultivation. The per capita net income of farmers of this area is over CNY6,000, higher than the averages of Baiyin Municipality (CNY4,497) and Jingyuan County (CNY4,836).

90. In Nanchuan and Nanshanwei Villages, domestic water is from tap water originating from the Yellow River. In some remote areas, farmers store domestic water diverted from irrigation canals in cellars. A cellar has a volume of about 30 m^3, and two irrigations a year are sufficient for annual water consumption. 95.5% of the rural respondents in this area are satisfied or largely satisfied with rural water supply, and only 4.5% are dissatisfied.

91. Over 70% of laborers in these two villages do farm work or do odd jobs in nearby areas. However, about 60% of young laborers aged below 30 years work elsewhere, mainly in Baiyin and Lanzhou Municipalities.

92. Land acquisition and house demolition will affect some households in these two villages. Their overall attitude is they are willing to support the Project as long as they receive reasonable compensation and resettlement. In addition to basic property compensation, most of them expect job opportunities from the Project to ensure their long-term livelihoods.

5.2.3 Enterprises

93. LIP is planned as a heavy and chemical industrial park, and will mainly attract large and medium productive enterprises, which can generate numerous jobs.

94. Therefore, most of the enterprises to settle into LIP will be related to non-ferrous metal processing, new energy source, building materials and logistics, with an estimated total investment of over CNY30 billion. It is expected that these enterprises will generate over 150,000 direct jobs when put into operation.

95. As of the time of the survey, two large industrial enterprises are under construction in LIP, and over 10 enterprises have committed locating in LIP. Among these enterprises, Gansu Kaisi Porcelain Industry Co., Ltd. started operation in March 2014. The existing large industrial enterprise in LIP is Gansu Rare Earth Co., Ltd., whose employees and their dependents amount to about 5,000. When the two enterprises newly introduced in 2014 start operation, it is expected that LIP will have an additional workforce of about 2,000 by the end of 2014.

96. Enterprises are one of the most important stakeholders of the Project. Their basic features and needs are.

(1) The current progress of infrastructure construction (water and power supply, road construction, and land leveling) of LIP cannot meet the demand of the introduced enterprises. Therefore, the first enterprises in LIP have to take many temporary measures to ensure production. These enterprises strongly expect the Project to break ground as soon as possible.
(2) The introduced enterprises will operate while constructing workshops and facilities. However, the serious shortage of supporting facilities will affect their production. For example, the problems that they cannot solve include the daily transport of employees from LIP to the urban area of Baiyin City or Jingyuan County town. For this reason, these enterprises have to recruit employees from rural areas close to LIP only.

97. In the LIP planning area, there is a large state owned enterprise, Gansu Rare Earth Company. It was established in 1969, and has a staff of about 2,000 at present. The company's area is divided into two parts, a production area and a living area. At present, the living area of the company has become a big community with staff and family members of 11,000. The company has water supply facilities for production and domestic living, as well a wastewater disposal and reuse system. However, the domestic wastewater is not well treated, and is mainly used for direct irrigation of trees and glass land.

98. The rare earth company is considered in the project design in two ways. First, a new rare earth industrial park is under planning in LIP and will benefit from the LIP infrastructure component. Second, the LIP infrastructure component will benefit the rare earth company by supporting water supply and wastewater treatment services for production and living.

5.2.4 The ITS facilities' users

99. The ITS component of this project will mainly focus on Baiyin District, and some main roads near the urban area of Baiyin District. The ITS component will benefit the public and users from nearby areas as well as other areas.

100. in the field interviews, more than 90% of urban interviewees and FGD participants thought that the ITS facilities are necessary as many citizens and drivers often do not obey the traffic rules. All drivers who participated in the interview and FGD had disobeyed traffic rules before, because traffic police will not record and punish them and other drivers and the public who disobey traffic rules have influenced them. All drivers support the ITS component.

5.2.5 Local government

101. The LMC is a sub-county-level agency affiliated to the Jingyuan County Government, responsible for LIP's construction, operation and management. It has divisions on political affairs, planning and construction, finance, investment promotion, labor protection, and land management. As of the time of the survey, the management committee had a workforce of 36, including six women.

6 Social Benefits of the Project

102. The implementation of the Project and the development of LIP are expected to generate 70,000 temporary jobs and 92,000 permanent jobs in the long term, benefiting urban and rural surplus labor in Baiyin City and Jingyuan County directly. The Technical and Vocational Education and Training component will improve local vocational education and provide skilled labor to LIP. The Intelligent Traffic Management System component will benefit the urban population of 276,500 of Baiyin Municipality directly and a population of over 510,000 in the remainder of Baiyin Municipality.

6.1 Offering job opportunities to increase income

103. The greatest social benefit of LIP is generating numerous jobs, which can be generally divided into:

(1) new jobs during infrastructure construction and after operation in LIP;
(2) new temporary jobs during the workshop and facility construction of enterprises in LIP, and new permanent jobs during their operation; and
(3) other new service jobs offered to employees and their dependents during LIP construction and operation, especially during operation.

104. The design institute estimates that about 131 skilled and 150 unskilled jobs will be generated at the Project construction stage. At the operation stage, 75 skilled jobs and 31 unskilled jobs (road maintenance, road cleaners, landscaping workers etc.) will be provided. Furthermore, with further construction of the LIP, more and more enterprises will move in; it is expected that enterprises will generate 77,859 job opportunities, and 8,392 jobs created from the services sector in LIP. Based on communication with Women's Federation, 40% of these jobs will first be made available to women.

Table 19: Job Opportunities Generated Directly and Indirectly by the Project (2020)

No.	Component	Construction stage				Operating stage				LIP Job opportunities			
		Skilled		Unskilled		Skilled		Unskilled		Generated by enterprises		Generated by services sectors	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	Liuchuan Industrial Park infrastructure									54,189	23,670	5,035	3,357
	1.1 Road	15	3	20	5	2	0	3	10				
	1.2 Water supply	30	10	40	20	20	15	5	5				
	1.3 Wastewater	25	8	30	25	12	10	2	2				
2	ITS	30	10	5	5	8	8	2	2				
3	TVET	100	31	95	55	42	33	12	19	54,189	23,670	5,035	3,357
Total		131		150		75		31		77,859		8,392	

Source: Local design institute's estimates

Table 20Job Creation in Liuchuan Industrial Park (2020)

No.	Enterprise	Total number of employees	Of which female
1	Gansu Hongtai Aluminum Co Ltd	6,000	1,600
2	Gansu Kaisi Ceramics Co Ltd	7,000	2,300
3	Baiyin Jiarui Ceramics Co Ltd	165	50
4	Jingyuan Power Plant (replacing small units with large ones)	5,000	1,200
5	Gansu Lantong Electric Cables Co Ltd	530	240
6	Gansu Rare Earth New Materials Shareholding Co Ltd	21,000	6,500
7	Baiyin Hualu Aluminum Co Ltd	1,564	430
Subtotal		***41,259***	***12,320***
8	**Enterprises settling later in park**		
9	Gansu Shengyuan Agricultural Produce Storage and Transport Co Ltd	800	450
10	Shanghai Zhongjin Logistics	20,000	9,000
11	Solar thermal power specialist equipment manufacturing park	5,000	1,300
12	Gansu Hongda Ceramics Co Ltd	800	300
13	Coal chemical integration	10,000	300
Subtotal		***36,600***	***11,350***
Total		**77,859**	**23,670**

Source: PMO

105. According to the LIP Master Development Plan (2010-2030)[①], by 2030, there will be 92,308 jobs in LIP, including 83,916 jobs offered by the dominant industries and 8,392 service jobs. Based on the average pay of enterprise employees in Baiyin Municipality of CNY24,000, these jobs will generate additional income of CNY2.21539 billion.

106. By 2030, LIP will have a resident population of about 68,000. 50% of the employees in LIP will settle in LIP, 30% live in nearby rural areas, 10% in dormitories, and the other 10% (intermediate and senior executives) will live in the Jingyuan County town, the urban area of Baiyin City or elsewhere. Therefore, about 46,000 jobs will need residential land in LIP.

Table 21-3: Estimated Jobs and Resident Population in LIP (2030)

No.	Type of jobs		Number of jobs offered
1	Dominant industries in LIP	Industry	79,745
		Storage and logistics	4,171
2	Service jobs		8,392
3	Total (all jobs in LIP)		92,308
4	Jobs with accommodation in LIP		46,000
5	Residential population of LIP		68,000

Source: LIP Master Development Plan (2010-2030)

107. However, the above figures do not include temporary jobs generated at the construction stage. The DI estimates that 20,000 new jobs will be generated during infrastructure construction and operation, and 50,000 during the workshop and facility construction of enterprises.

Table 22: Statistics of Expected New Jobs

Job statistics	Number
New permanent jobs (by 2030)	92,308
New temporary jobs (by 2030)	70,000

[①] There are different versions of the LIP Development Plan with different estimates of employee numbers. The 23 km^2 Control Detailed Development Plan of LIP estimates that by 2015, LIP will offer 46,000 permanent jobs. The LIP Development Plan (2013-2020) estimates that by 2020, LIP will offer 40,000 permanent jobs. The LIP Master Development Plan (2010-2030) estimates that by 2030, LIP will offer 92,308 permanent jobs. Although the Project will serve an area of 23 km^2 in the near term (by 2020), the estimates in the third plan are still used here in consideration of logical consistency and reliability.

108. These new jobs are expected to benefit the whole of Jingyuan County, Baiyin City and surrounding areas. The beneficiary areas and groups at different stages include:

(1) During the infrastructure construction of LIP, all new jobs will be offered to local labor, mainly from Baiyin District and Jingyuan County.
(2) With the progress of LIP construction and the gradual entry of enterprises, the number of jobs for operation, management and service will increase dramatically. It is expected that employees will be from Jingyuan County, Baiyin City and surrounding areas.
(3) The workshop and facility construction of enterprises in LIP will be a continuous process, and jobs will be generated gradually. Construction jobs will be offered to local labor mainly, but jobs generated by the construction and installation of specialized production facilities may cover nearby areas, and even other provinces and cities.
(4) New permanent jobs generated at the operation stage of enterprises in LIP are mainly related to enterprise operation, production and management will cover the whole of Baiyin Municipality and surrounding areas.
(5) At the end of the planning period, there will be 8,392 jobs related to offer of services to employees in LIP and their dependents. These jobs will be generated gradually with the construction and development of LIP, and offered mainly to employees' dependents, local farmers, unemployed or semi-unemployed local urban residents etc.

6.2 Social Benefits of LIP Road Construction Subcomponent

109. In total 35 roads will form the industrial park road network. The proposed Xihuan (west ring) Road under the ADB financed project is an urban trunk road designed as part of the road network of the industrial park. The road network is planned in line with related master plans and detailed plan requirements to meet the needs for freight transport and commuter accesses. Xihuan Road is part of "three vertical and one horizontal and one ring" of the overall network. It will form part of the ring roads around the industrial park.

110. This road is the core of the road network of LIP, and will serve a total population of 120,000 in the long term.

6.3 Social Benefits of LIP Water Supply and Wastewater Treatment Subcomponents

111. The subcomponents will serve the 23-km^2 planned area of LIP in Jingyuan County by year 2020. The current water supply and wastewater facilities are insufficient to serve the number of industries planned for the LIP. Previously it was planned to provide water supply to two villages inside the Industrial Park (Nanshanwei and Nanchuan Villages) and to the new Resettlement Village located to the south of LIP. However, Gansu Province is providing funds for village water supply improvements through the "1236 policy" and Jingyuan County Government has provided written assurance the two villages are included in the "Jingyuan County Drinking Water Safety Project" that will be completed in year 2014, so there is no need to serve them from the LIP water supply.

112. It is planned that the water purification plant and WWTP will serve industrial enterprises and residents in LIP mainly, with a directly served population of over 120,000.

6.4 Social Benefits of Technical and Vocational Education and Training

113. 94.7% of the respondents have been employed before, 20.8% currently work full-time jobs, 37.8% currently work part-time jobs, and 41.5% are currently unemployed. Among those doing full- or part-time jobs, 18% are factory workers, 8.2% administrative workers of

enterprises and public institutions, 17.7% farmers, 23.1% self-employed, and 33% other employees. Among these respondents, only 8.1% work skilled jobs, 43.4% think their jobs are somewhat skilled, and 48.4% do unskilled jobs.

Table 23: Current Employment Status

	Valid percent
Full-time	20.8
part-time	37.8
Unemployed	41.5

Table 24: Types of Work of Employed Respondents

	Valid percent
Production worker	18
Administrative worker	8.2
Agricultural worker	17.7
Self-employer	23.1
Other	33

Table 25: Self-evaluated Skill Levels of Current Jobs

	Valid percent
Skilled	8.1
Somewhat skilled	43.7
Unskilled	48.1

114. Among the respondents who have been employed before, 58.2% have never received any relevant skills training, 11.6% have received training from intermediate vocational schools, 6.6% have received training from senior vocational schools, 12.4% have received short-term training courses, and 5.8% have received internal training. Correspondingly, 42.8% of the respondents have no diploma or vocational certificate, 23.3% have a junior high school diploma or junior vocational certificate, 21.8% have a senior high school diploma or intermediate vocational certificate, 8.8% have a college diploma or senior vocational certificate, and 2% have a short-term training diploma or certificate. Regardless of the type of diploma or vocational certificate, only 11.4% of the respondents think that diplomas or certificates are directly related to their past or current jobs, 43.7% think that they are irrelevant, and 24.5% think that they may be partly relevant.

Table 26: Have you received vocational training?

	Valid percent
Training by intermediate vocational school (secondary technical school)	11.6
Training by senior vocational school	6.6
Short-term training course (1-3 months)	12.4
Internal training	5.8
Other	5.3
None	58.2

Table 27: Do you have a diploma or vocational certificate?

	Valid percent
Junior high school diploma / junior vocational certificate	23.3
Senior high school diploma / intermediate vocational certificate	21.8
College diploma / senior vocational certificate	8.8
Short-term training diploma / certificate	2
Other	1.5
No diploma or vocational certificate	42.8

Table 28: Is the diploma or vocational certificate directly related to your most recent job?

	Valid percent
Relevant	11.4
Irrelevant	43.7
Somewhat relevant	24.5
Not applicable	20.4

115. The overall percentage of the respondents having received vocational education is low, but their willingness to receive vocational training is high. 20.3% of the respondents do not want to receive new vocational training, 18.5% are willing to receive any type of vocational training, 32% expect short-term vocational training, 24.5% expect senior vocational training, and 4.8% expect intermediate vocational training. In summary, 79.7% of the respondents are willing to receive vocational training.

Table 29: Expectations for Vocational Education

	Valid percent
Intermediate vocational school (secondary technical school)	4.8
Senior vocational school	24.5
Short-term training course (1-3 months)	32
Any of the above	18.5
None interested	10
Do not know	10.3

116. 25.8% of the respondents willing to receive vocational training expect to learn production skills for factory or enterprise employment, 28.5% expect to learn administrative skills for factory or enterprise employment, 19.5% expect to learn agricultural skills, 18% expect to learn individual business skills, and 8.3% expect to learn other practical skills. In summary, 54.3% of the respondents willing to receive vocational training expect to learn production and administrative skills for factory or enterprise employment.

Table 30: Expected Vocational Skills

	Valid percent
Production skills for factory or enterprise employment	25.8
Administrative skills for factory or enterprise employment	28.5
Agricultural skills	19.5
Individual business skills	18
Other	8.3

117. In the project area, the total of urban unemployed and semi-unemployed population and rural surplus labor is about 189,000, and there is a recessively employed population of about 20,000. As described above, by 2030, LIP is expected to offer 92,000 permanent jobs and 70,000 temporary jobs. This means that over 50% of the local surplus labor will improve their skills and receive new jobs from LIP by receiving different types of vocational training.

6.5 Social Benefits of Baiyin Intelligent Traffic Management Systems

118. The Intelligent Traffic Management Systems component will serve the urban area of Baiyin City mainly, and is designed to improve urban road traffic order and efficiency, regulate public traffic behavior, and raise public traffic safety awareness.

119. According to the data of the municipal traffic police detachment (traffic police authority), by 2013, Baiyin Municipality had a total road mileage of 9,003.913 km. This includes 3 national highways with a total length of 355.88 km, 5 provincial highways with a total length of 531.912 km, rural roads with a total length of 1,792.135 km, and special roads with a total length of 6,320.986 km. The municipality had over 160,000 motor vehicles and over 260,000 motor vehicle drivers. In the past 3 years, the number of motor vehicles grew by 25,000 and the number of drivers by 30,000 per annum.

120. The basic problems in road traffic management in Baiyin Municipality are: (1) the numbers of motor vehicles and road accidents grow rapidly; (2) the traffic police force is insufficient, there are not enough intelligent traffic management systems, and there is an absence of traffic control in many areas.

121. Currently, the municipal traffic police detachment has 168 traffic policemen, but 396 should be needed based on the road mileage and number of motor vehicles of Baiyin Municipality, which means a gap of 228. Although there are 30 traffic policemen and 30 police wardens in the urban area of Baiyin Municipality, the police force is still seriously insufficient.

122. In the meantime, with the rapid growth of motor vehicles, the number of traffic accidents is rising sharply. Common traffic violations include over-speed driving, unlicensed driving, tired driving, drunken driving, illegal parking etc. In 2013, 412,206 traffic violations occurred in Baiyin Municipality, including 137 fatal traffic accidents, 295 non-fatal ones and 6 resulting in property losses. Accidents not handled and counted due to insufficient police force are not included here.

123. Currently, the intelligent traffic management facilities of Baiyin Municipality include over 80 sets of road junction signals, over 30 sidewalk signals, 46 automatic video systems etc. on main urban roads, with a coverage rate of less than 50%. Almost all rural roads are unmonitored.

124. **The Project will generate great social benefits, mainly reduction of the number of urban traffic violations, and reduction of casualties and property losses arising from traffic accidents.** It is estimated that the total amount of direct and indirect financial losses arising from traffic accidents and violations in Baiyin City exceeds CNY200 million. It is estimated after intelligent traffic management systems are provided, the number of traffic violations will be reduced greatly, thereby reducing financial losses and the probability of major traffic accidents.

Table 31: Statistics of Fatal Traffic Accidents in Baiyin Municipality (2013)

Item	Frequency		Persons killed		Persons injured	
	N	Increase or decrease from previous year, %	N	Increase or decrease from previous year, %	N	Increase or decrease from previous year, %
Baiyin Municipality	137	38.38%	166	39.5%	84	-11.58%
Baiyin District	20	25%	25	47.06%	11	-57.69%
Pingchuan District	23	64.29%	27	92.86%	11	83.33%
Jingyuan County	30	42.86%	36	20%	19	-24%
Huining County	32	33.33%	39	50%	26	18.18%
Jingtai County	32	33.33%	39	21.88%	17	6.25%

Source: Municipal traffic police detachment

Table 32: Statistics of Non-fatal Traffic Accidents in Baiyin Municipality (2013)

Item	Frequency		Persons injured	
	N	Increase or decrease from previous year, %	N	Increase or decrease from previous year, %
Baiyin Municipality	295	59.46%	460	60.28%
Baiyin District	50	38.89%	82	74.47%
Pingchuan District	50	19.05%	73	2.82%
Jingyuan County	87	480%	137	495.65%
Huining County	88	51.72%	140	70.73%
Jingtai County	20	-41.18%	28	-56.25%

Source: Municipal traffic police detachment

Table 33: Statistics of Traffic Accidents Resulting in Property Losses in Baiyin Municipality (2013)

Item	Frequency		Property losses	
	N	Increase or decrease from previous year, %	N	Increase or decrease from previous year, %
Baiyin Municipality	6	0%	20,800	9.47%
Baiyin District	2	100%	8,000	100%
Pingchuan District	1	100%	5,000	100%
Jingyuan County	0	0%	0	0%
Huining County	2	-50%	7,000	0%
Jingtai County	1	-50%	800	-93.33%

Source: Municipal traffic police detachment

125. According to the project design, the beneficiary population of the Intelligent Traffic Management Systems component includes:

(1) a direct beneficiary population of 207,400 in the urban area of Baiyin Municipality;
(2) a population of 510,000 person-times entering the urban area from the remainder of Baiyin Municipality and other areas; and
(3) non-local vehicles and persons passing through the local trunk roads involved in this component, with a conservative estimate of 1 million person-times.

126. FGDs reveal that residents welcome the component since it can bring smooth, safe traffic and good management, reduce the number of urban traffic violations and avoid casualties and property losses. Especially for children and old people may pass the street with safety more easily. Drivers including women drivers expressed that they need to obtain the knowledge and rules of the Intelligent Traffic Management Systems. In addition, women residents hope that the traffic safety education program can also be conducted in schools and their children can benefit from the component.

7 Social Risks of the Project

127. The social risks of the Project are reflected mainly in the fact that:

(1) local surplus labor worries about the employment environment of LIP, and the protection of labor rights and interests, etc., which may result in inadequate labor supply to LIP,
(2) trainees from the vocational education and training system are unwilling to bear training costs, and
(3) the development of vocational education may encounter policy and financial bottlenecks.

128. In addition, institutional arrangements required for the future effective management of LIP may be a potential source of social risks.

7.1 Expectations and Concerns about Employment

129. 55% of the respondents are willing to work in LIP after its completion, 35.5% will depend, and only 9.5% are unwilling. 36.8% of those willing to work in LIP expect to be unskilled workers, 25.3% expect to do skilled jobs, 10% expect to do administrative jobs, and 17% are unclear.

Table 34: Expectations for Employment in LIP

	Willing	Unwilling	Depends
Rural	55.5%	10.5%	34%
Urban	54.5%	8.6%	36.8%
Total	55%	9.5%	35.5%

130. 35% of the respondents unwilling to work in LIP choose long distance as the primary reason, 22% choose serious environmental pollution in LIP, 22% choose unsuitable age or physical condition, and 12.8% choose no skill.

Table 35: Reasons for Not Working in LIP

	First choice			Second choice		
	Rural	Urban	Total	Rural	Urban	Total
Long distance from home	15.9%	62.5%	35%	0%	5.3%	2.5%
Serious environmental pollution in LIP	31.9%	8.3%	22.2%	9.5%	21.1%	15%
Unsuitable age or physical condition	21.7%	22.9%	22.2%	47.6%	26.3%	37.5%
No skill	17.4%	6.3%	12.8%	42.9%	36.8%	40%
Other	13%	0%	7.7%	0%	10.5%	5%

131. Another question has cross validated the numerous reasons for not working or concerns about working in LIP. 56.4% of the respondents choose employee dormitory as the first expectation for working in LIP, 23.5% choose a commuting bus from LIP to the urban area of Baiyin City or Jingyuan county town, 17.4% choose employee activity center, health station, sports facility, etc., and a few choose low rental housing and other measures for improving the living environment.

Table 36: Expectations for Working Environment in LIP

	First choice			Second choice		
	Rural	Urban	Total	Rural	Urban	Total
Employee dormitory	52.4%	60.2%	56.4%	4.9%	7.1%	6.1%
Health station	6.3%	4%	5.1%	3.3%	7.7%	5.6%
Employee activity center	13.1%	8%	10.5%	14.8%	6.1%	10.3%
Sports facility	1.6%	2%	1.8%	3.3%	4.1%	3.7%
Commuting bus	23%	23.9%	23.5%	43.4%	61.7%	52.9%
Low rental housing	3.1%	2%	2.6%	25.8%	13.3%	19.3%
Other	0.5%	0%	0.3%	4.4%	0%	2.1%

132. Although some urban and rural surplus laborers are unwilling to work in LIP, 32.3% of the respondents are willing to deal with commercial services or start up business in or around LIP when it is developed. This means that LIP will generate jobs both directly and indirectly.

Table 37: Percentage of respondents willing to do business or start up businesses in LIP

	Willing	Unwilling	Depends
Rural	22.8%	10.9%	66.3%
Urban	42.3%	19.6%	38.1%
Total	32.3%	15.2%	52.5%

7.2 Protection of Labor Rights and Interests

133. Only 9.8% of the respondents know some details about the Labor Law, 88.5% know a little, and few have never heard of it. There are little differences in the awareness of the Labor Law between urban and rural surplus labor.

Table 38: Awareness of the Labor Law

	Never heard of	Know a little	Know some details
Rural	3.7%	92.7%	3.7%
Urban	0%	84.7%	15.3%
Total	1.8%	88.5%	9.8%

134. Compared to the Labor Law, the respondents are more aware of social insurance and housing fund. 16.3% of the respondents know some details of social insurance and housing fund, but still 81% have just heard of them.

Table 39: Awareness of Social Insurance and Housing Fund

	Never heard of	Know a little	Know some details
Rural	5.2%	89.5%	5.2%
Urban	0.5%	73.2%	26.3%
Total	2.8%	81%	16.3%

135. 16.3% of the respondents are willing to work overtime, 41.5% are unwilling, and 41.5% depend. This shows that overtime work is acceptable to most people but depends. For example, 74% of the respondents say that they refuse to work overtime without overtime pay or subsidy.

Table 40: Are you willing to work overtime?

	Willing	Unwilling	Depends	Don't know
Rural	16.8%	40.8%	41.9%	0.5%
Urban	15.8%	42.1%	41.1%	1%
Total	16.3%	41.5%	41.5%	0.8%

136. In case of non-payment of wages, 73.4% of the respondents will resort to the government, 14.5% will strike until being paid, only 7.5% will file a lawsuit, and 2% do not know what to do.

Table 41: Countermeasures against Non-payment of Wages

	First choice			Second choice		
	Rural	Urban	Total	Rural	Urban	Total
Striking until being paid	12.1%	16.7%	14.5%	1.6%	9.6%	5.4%
Resorting to friends	2.1%	1.9%	2%	5.6%	5.2%	5.4%
Withholding properties of the employer or boss	0.5%	0%	0.3%	0.8%	1.7%	1.3%
Resorting to the government	77.9%	69.4%	73.4%	16.8%	11.3%	14.2%
Filing a lawsuit	4.2%	10.5%	7.5%	74.4%	69.6%	72.1%
Do not know	2.6%	1.4%	2%	0.8%	1.7%	1.3%
Other	0.5%	0%	0.3%	0%	0.9%	0.4%

137. Enterprises to settle in LIP are mostly large and medium heavy chemical enterprises, and some jobs may be hazardous. 46% of the respondents are willing to do such jobs as long as there are acceptable protective measures and high pay, 11% are willing with acceptable protective measures only, and 37.8% are unwilling. Only 25.1% of the rural respondents are willing to do such jobs as long as there are acceptable protective measures and high pay, while this percentage is 65.1% among the urban residents. 57.1% of the rural respondents are unwilling to do such jobs, while this percentage is 20.1% among the urban residents.

Table 42: Are you willing to do a dangerous job?

	Rural	Urban	Total
Willing without protective measures as long as pay is high	1.6%	0.5%	1%
Willing with protective measures only	14.7%	7.7%	11%
Willing with protective measures and high pay	25.1%	65.1%	46%
Unwilling	57.1%	20.1%	37.8%
Depends	1.6%	6.7%	4.3%

138. There may be many reasons for the above differences. Interviews reveal that differences between urban and rural labor in educational level, reliance of household income on such jobs, and selectivity and substitutability of jobs are important reasons. For example, 57% of the rural respondents have received junior high school or below education, while this percentage is 29.2% among the urban respondents. In addition, the household income of urban surplus labor relies highly on wage income, while that of rural surplus labor relies relatively lowly on wage income because part of household income is from farming. For these reasons, though urban laborers have a more rational understanding of hazardous jobs, they are more willing to do such jobs due to their high reliance on wage income.

Table 43: Educational Levels

	Rural	Urban	Total
Illiterate or semiliterate	0.5%	0%	0.3%
Primary school	9.9%	1.4%	5.5%
Junior high school	46.6%	27.8%	36.8%
Senior high school	26.2%	36.4%	31.5%
Secondary technical school	8.4%	15.3%	12%
Junior college	6.8%	13.9%	10.5%
University or above	1.6%	5.3%	3.5%

139. Among the respondents who have been employed before, only 43.2% have signed a labor contract, where this percentage is 31.5% among the rural respondents and 51.7% among the urban respondents. 46.8% of the respondents do not know the need for a labor contract, 31.5% choose “The employer does not want to sign with me”, and 9.7% do not want to sign a labor contract. Urban and rural differences are also significant here. 55.1% of the rural respondents do not know the need for a labor contract, while this percentage is only 38.5% among the urban respondents; 15% of the rural respondents do not want to sign a labor contract, while this percentage is only 4.6% among the urban respondents.

Table 44: Did you sign a labor contract in past employment?

	Yes	No
Rural	31.5%	68.5%
Urban	51.7%	48.3%
Total	43.2%	56.8%

Table 45: Reasons for not signing a labor contract

	Rural	Urban	Total
Do not know the need for a labor contract	55.1%	38.5%	46.8%
The employer does not want to sign with me	18.7%	44%	31.5%
Do not want to sign	15%	4.6%	9.7%
Other	11.2%	12.8%	12%

140. 63.6% of the respondents did not cover labor insurance in past employment, and the percentage among rural respondents is as high as 77.5%. Among reasons for not covering labor insurance, 43.9% do not know the need for labor insurance, 42.1% choose "The employer does not cover insurance for me", and 14% do not' want to cover insurance for higher cash income. Urban and rural differences are also significant here. 59% of the rural respondents do not know the need for labor insurance, while this percentage is only 27.9% among the urban respondents; 28.2% of the rural respondents choose "The employer does not cover insurance for me", while this percentage is 56.8% among the urban respondents. This shows that rural labor does not cover labor insurance due to the lack of knowledge and awareness of labor insurance, while urban labor does not cover labor insurance mainly because employers do not cover insurance for them.

Table 46: Did you cover labor insurance in past employment?

	Yes	No
Rural	22.8%	77.2%
Urban	46.5%	53.5%
Total	36.4%	63.6%

Table 47: Reasons for not covering labor insurance

	Rural	Urban	Total
Do not know the need for labor insurance	59%	27.9%	43.9%
The employer does not cover insurance for me	28.2%	56.8%	42.1%
I do not want to cover insurance	12.8%	15.3%	14%

7.3 Challenges and Development Opportunities for the Vocational Education and Training System

141. To meet the demand of economic and social transformation of Baiyin City, it is necessary and urgent to develop vocational education. However, there are many difficulties in this respect.

(1) Enterprises expect to recruit skilled workers or make recruits skilled through short-term vocational training, and are unwilling to provide systematic vocational training to workers doing unimportant skilled jobs.
(2) In Baiyin Municipality, there are 89 vocational schools, 17 secondary schools and a special education school, with annual vocational training of over 50,000 person-times.
(3) Despite the municipality's rich vocational training resources, vocational training is focused on general skills training, and is unable to provide specialized vocational training suited for heavy chemical enterprises in LIP.
(4) Among various types of local vocational training, trainees bear most training costs and subsidies from public finance are limited. 16.5% of the respondents are willing to bear vocational training expenses, 56% are unwilling, and 27.5% will depend. This means that training costs have actually become an obstacle for surplus labor to receive further vocational training.

142. It is undeniable that the local vocational education system faces with great opportunities with the construction and development of LIP, and the industry restructuring and urban transformation of Baiyin Municipality, which will promote the overall development of the vocational education system. The Baiyin Municipal Government's policy and financial support for the vocational education system will be necessary and critical.

7.4 Potential Environmental Risks

143. Enterprises to settle in LIP are large and medium heavy chemical enterprises mainly, and will inevitably produce large quantities of industrial waste gases, dust, wastewater and slag, thereby resulting in environmental pollution and destruction.

144. LIP is located in a desert between Baiyin City and Jingyuan County. In general, this area is convenient for the dispersion of pollutants, especially industrial waste gases, and this area has a low population density, so impacts of industrial waste gases will be slight. However, with the increase of population in this area in the future, the environmental pollution from industrial waste gases and dust will intensify gradually.

145. Large and medium heavy chemical enterprises will produce large quantities of industrial wastewater, which can be reflected in the planned long-term treatment capacity of the WWTP of 35,000 m^3/day. Currently, wastewater produced by the rare earth plant in LIP is discharged directly into the Yellow River, and tail water from the WWTP will be discharged directly into the Yellow River as well. This will not only affect the water quality of the Yellow River, but also leave industrial pollutant residues in the nearby soil, affecting the health of the local population continuously and indirectly.

146. In addition, large and medium heavy chemical enterprises will also produce large quantities of industrial slag. Different from the flowing pollutants of industrial waste gases, dust and wastewater, industrial slag can be disposed of centrally. There is a landfill for industrial slag in the project area, but planning and financial support will be required.

147. In addition to the above potential environmental risks, effective supervision by the environmental regulator of the government will be the most important mechanism for minimizing environmental risks. Although the Jingyuan County Environmental Protection Bureau is responsible for environmental supervision and law-enforcement in LIP, the following issues exist:

(1) All enterprises introduced and to be introduced into LIP are large and medium enterprises, and their environmental approval authority belongs to the Baiyin Municipal Environmental Protection Bureau or even the Gansu Provincial Environmental Protection Department; besides, the Jingyuan County Environmental Protection Bureau has no capacity or authority to supervise such large and medium enterprises. This may result in functional conflicts between the county environmental protection bureau, municipal environmental protection bureau and provincial environmental protection department in practice.
(2) Based on the principle of territorial management, all enterprises in LIP must be subject to environmental supervision by the Jingyuan County Environmental Protection Bureau, which, however, faces difficulty of inadequate supervisory capacity, as reflected mainly in its shortage of technicians, equipment and qualifications for environmental supervision. Thus, the Jingyuan County Environmental Protection Bureau may be unable to conduct environmental supervision effectively even if it has the authority to do this.

148. The Environmental Impact Assessment will address the environmental risks of the Project and appropriate measures. However, since environmental and social risks are highly inter-convertible, an environmental management plan must be developed in advance, and will include countermeasures against social risks.

7.5 Other Potential Risks

149. **Involuntary resettlement and potential social risks**: The Project will have significant land acquisition and resettlement impacts, and thus is classified as Category A for the

resettlement safeguard. The Project will affect three groups of two villages in the project area. In total 1,019.05 mu will be occupied permanently, including 403.74 mu of collective land and 615.31 mu of state-owned land. 8,074.41 m² of residential housing will be demolished, and the Project will affect in total 111 households/entities with 563 persons. The estimated resettlement cost of the project is CNY99.03 million.

150. A resettlement plan was prepared in line with ADB's Safeguard Policy Statement (2009) and relevant laws and regulations of the PRC. The plan was endorsed by BMG and disclosed to affected people in the local language. The affected people will be compensated for all affected assets (permanent and temporary impacts) at full replacement cost. BPMO will coordinate implementation of the project and report progress to ADB. Land Resources Bureau and House Demolition and Resettlement Office will carry out land acquisition, house demolition, and implementation of the resettlement plan. A grievance redress procedure has been established for the affected persons. BPMO will engage an external monitoring institute to verify adherence to provisions of the resettlement plan independently.

151. **Labor risks**: About 131 skilled and 150 unskilled jobs will be generated at the Project construction stage. At the operation stage, 75 skilled jobs and 31 unskilled jobs (maintenance, cleaners, landscaping workers, etc.) will be provided. Furthermore, with the construction of the LIP, more and more enterprises will settle there. It is expected that enterprises will generate 77,859 jobs opportunities, and 8,392 jobs will be created in the services sector in LIP.

152. Vocational training and on job training program will be provided to workers or students or labor to be hired by enterprises. Related labor laws, policies and safety knowledge will be included to improve labor right protection.

153. In addition, to ensure the health and safety of employees, relevant requirements should be specified in the tender documents. For example, the contractor should provide necessary medical and first-aid services to construction workers during construction, and give education on disease control to construction workers, especially infectious diseases like AIDS, SARS and hepatitis.

154. **Affordability**: The Project will involve the ability to pay for water supply and wastewater treatment of future enterprises in LIP and households living in LIP. For enterprises, water supply and drainage costs are part of production costs, and their ability to pay is not discussed here. For future households living in LIP, it is also difficult to analyze their ability to pay, because it is impossible to predict their composition and economic conditions.

155. Currently, the water rate of the Jingyuan county town[①] is CNY2.75/m^3, and average monthly water consumption is about 6 m^3 per household. Based on the per capita net income of farmers (CNY4,836 per capita per annum in 2012) and rural poverty line (CNY2,300 per capita per annum) of Jingyuan County[②], and the per capita disposable income of urban residents (CNY12,980 per capita per annum) and urban minimum living standard (MLS) (CNY245 per capita per annum) of the Jingyuan county town, the ability to pay will be as follows:

[①] This water rate includes the wastewater treatment rate.
[②] The population living in LIP in the future can generally be regarded as urban residents, and their overall income level should be higher than that of rural residents. Therefore, the estimated ability to pay here is based on per capita net income of farmers and rural poverty line to reflect that of low-income population.

Table 48: Ability to Pay①

Type	Annual water consumption (m^3/month)	Annual water expenses (CNY)	Average annual household income (CNY)	Percentage to household income
Rural poor households	3	99	8,050	1.23%
Rural ordinary households	5	165	16,926	0.97%
Urban MLS households	4	132	10,290	1.28%
Urban ordinary households	6	198	45,430	0.44%

156. The above data shows that domestic water expenses will account for 1.26% and 0.97% of the income of rural poor and ordinary households respectively, and 1.28% and 0.44% of the income of urban poor and ordinary households respectively. These levels will be affordable. However, due to the potential future variation of the water rate and the income uncertainty of water users, the water supply and wastewater treatment rates of LIP should be fixed in consultation with local residents.

157. According to the project design, the community in the rare earth company's living area will be potential beneficiaries of the project. At present, 11,000 persons and about 2,100 households, all of whom are employees, retired employees and their family members, live in the community. At present, the water treatment plant of the rare earth company provides water supply for the community, the water price is CNY2.5/m^3, and the average household water usage is about 5 m^3. The average salary of the rare earth company's employees is CNY3,500 per month, and that of retired employees about CNY2,500 per month. In general, each family has two people earning salaries. Even if only one family member of a household has salary, the water fees will account for about 0.5% of the household income, which will not bring great pressure to the family.

158. **Future management risks of LIP**: Currently, LIP is still at the infrastructure construction and investment promotion stage, and the LMC is responsible for operation and management. The management committee has a workforce of 36, which is sufficient for routine work. However, with the progress of LIP construction, and the increase of enterprises and employees, there will certainly be a great demand for public services and management, including policy consulting services for enterprises in LIP, living services for employees and residents in LIP, and public security, social security and management services, etc.

159. The availability of the above public services and the sustainable development of LIP will depend on a sound institutional design. It is necessary to plan and avoid potential risks.

160. **Shortage of public traffic knowledge and awareness**: Although the Intelligent Traffic Management Systems component will have significant social benefits, it is also necessary to further regulate public traffic behavior, and improve public traffic knowledge and awareness.

161. The municipal traffic police detachment carries out various traffic regulation activities every year, especially on important holidays, in harsh weathers, and during school opening periods, and organizes extensive publicity on traffic knowledge by means of TV, SMS, poster, and plant- and school-based publicity.

162. For example, in 2013, the municipal traffic police detachment carried out 97 major traffic safety publicity activities, in which they dispatched 2,320 person-times and 211 vehicle-times. One hundred and ninety-five traffic safety publicity stands were set up, and over 560,000 copies of publicity materials distributed.

① Rural households' affordability analysis is conducted for the people living in resettlement sites, and urban households' affordability analysis for the potential urban residents living in the LIP.

163. These measures have proven effective in improving public traffic knowledge and preventing traffic violations. It is advised that in the Intelligent Traffic Management Systems component, publicity and education on traffic knowledge and awareness, and punitive measures against traffic violations should be provided.

164. **Difficulties of poor people living in LIP**. For poor people, especially poor workers in LIP, living may become a new problem in future as they have low affordability to buy commercial apartments or rent apartments outside. However, according to an interview with Jingyuan Housing Management Bureau, two government supported low rental buildings with 72 apartments will be built in the year of 2014, and another 4 buildings with 144 apartments in the year of 2015. Meanwhile, Jingyuan County will also support relevant policies about low rental apartment buildings and other government supported apartment building projects. These activities will be included in the social development action plan.

8 Poverty Analysis

8.1 Poverty Situation of the Project Area

165. Although the PRC's poor population has been decreasing through over 30 years of rapid economic and social development, it still had a rural poor population of 98.99 million at the end of 2012, based on the rural poverty line of CNY2,300 per capita per annum, according to the National Economic and Social Development Statistical Bulletin 2012 issued by the National Bureau of Statistics.

166. Another common measure of the poor population is the number of people receiving social assistance. In October 2013, the PRC had an urban MLS population of 20.776 million, a rural MLS population of 53.55 million, a rural population under centralized five-guarantee support of 1.824 million, and a rural population under scattered five-guarantee support of 3.589 million. The urban MLS standard was CNY241.3 per capita per month and the rural MLS standard CNY106.4 per capita per month.

167. Usually, the rural poor population includes the rural MLS population and rural five-guarantee population, while the urban MLS population can be a basic estimate of the urban poor population. In 2012, it was estimated that the PRC's poor population (both urban and rural) was 119.766 million.

168. According to the Outline for Development-oriented Poverty Reduction for China's Rural Areas (2011-2020), there are 14 contiguous destitute regions in China, involving 680 counties. The main part of the Liupanshan contiguous destitute region is in Gansu Province, and 40 of the 61 key counties for development-oriented poverty reduction are in Gansu Province. Three of these 40 counties are in Baiyin Municipality, namely Jingyuan, Huining and Jingtai Counties. This means that except Baiyin and Pingchuan Districts, the rest of Baiyin Municipality is composed of key counties for development-oriented poverty reduction. In addition, Huining County in Baiyin Municipality is also one of the 592 state-level key counties for development-oriented poverty reduction of China[①].

169. The state promulgated the Twelfth Five-Year Development-oriented Poverty Reduction Plan in September 2012, covering 30,000 poor villages and 200 poor townships in the 22 province-level administrative divisions in central and western China, including 2,500 villages in Gansu Province. 100 villages in Baiyin Municipality were included, including 5 in Baiyin District, 50 in Huining County, 10 in Jingtai County, 25 in Jingyuan County and 10 in Pingchuan District.

170. Based on the rural poverty line of CNY2,300 per capita per annum in 2011, Gansu Province had a poor population of 12 million in 2011[②]. According to the Report 2014 on the Work of the Gansu Provincial Government, the province's poor population in 2013 was lower than that of 2012 by 1.4 million. It is estimated that at the end of 2013, the province's rural poor population was about 9.2 million, accounting for 57.5% of rural population, the rural MLS population was 3.4278 million, and the urban MLS population was 872,600. It is estimated that in 2013, Gansu Province's urban and rural poor population was 10.0726 million, accounting for 38.7% of the province's gross population.

171. In 2012, Baiyin Municipality had a poor population of 452,900, accounting for 35.86% of the rural population, distributed mainly in extremely dry mountain areas, closed down or reduced capacity coal mines, and sandstorm resettlement areas, involving 64 townships and

① Currently, 592 state-level key counties for development-oriented poverty reduction have been identified, and the 14 contiguous destitute regions cover 680 counties. The two lists overlap to some extent. This means that some of the 582 counties not covered by the 14 contiguous destitute regions are still state-level key counties for development-oriented poverty reduction.

② http://www.tibet3.com/news/content/2011-12/09/content_695903.htm

559 villages, in which 30 townships and 276 villages are province-level key counties and villages for development-oriented poverty. If the municipality's urban MLS population of 74,800 is included, it has a poor population of 527,700.

172. In 2012, Jingyuan County had a poor population of 161,500 and a poverty incidence of 37.89%. If the county's urban MLS population of 7,900 is included, the county has a poor population of 169,400, distributed mainly in dry mountain areas, high-lift areas, and areas along the Yellow River, because high-lift areas are short of water resources, and areas along the Yellow River are exposed to frequent natural disasters, such as hailstones, frosts and sandstorms.

Table 49: Rural Poor Population of the Project Area in 2012

Division	Gross population (0,000)	Rural population (0,000)	Poor population (0,000)	Rural poverty incidence
China	135404	64222	9899	15.41%
Gansu Province	2577.55	1578.75	1060	67.14%
Baiyin Municipality	174.3	126.28	45.29	35.86%
Jingyuan County	48.11	42.62	16.15	37.89%

Note: Poor population here excludes urban poor population.

Table 50: Rural MLS Data of the Project Area in October 2013

Division	Rural MLS population	Rural MLS households	Accumulated expenditure on rural MLS (CNY0,000)	Rural MLS standard (CNY)
China	53,558,055	28,888,397	5669525.3	106.43
Gansu Province	3,427,786	1,110,991	303016.9	88.27
Baiyin Municipality	229,050	56,260	26119.4	114.03
Baiyin District	8,381	2,562	854	101.9
Pingchuan District	16,622	4,377	1720.4	103.5
Jingyuan County	65,445	13,156	6589	100.68
Huining County	116,605	29,550	14456	123.97
Jingtai County	21,997	6,615	2500	113.65

Source: Website of the Ministry of Civil Affairs

Table 51: Urban MLS Data of the Project Area in October 2013

Division	Urban MLS population	Urban MLS households	Accumulated expenditure on urban MLS (CNY0,000)	Urban MLS standard (CNY)
China	20,776,348	11,001,136	5,080,870.5	241.34
Gansu Province	872,628	371,361	194,733	222.37
Baiyin Municipality	74,799	29,380	17,386.2	232.2
Baiyin District	38,281	15,238	9,020	235.63
Pingchuan District	11,599	4,228	2,518.2	215.69
Jingyuan County	7,900	3,460	1,801	227.97
Huining County	9,997	3,801	2,447	244.77
Jingtai County	7,022	2,653	1,600	227.86

Source: Website of the Ministry of Civil Affairs

Table 52: Estimated Urban and Rural Poor Population of the Project Area in 2012

Division	Gross population (0,000)	Rural poor population (0,000)	Urban poor population (0,000)	Gross poor population (0,000)	Overall poverty incidence
China	135404	9899	2077.63	11976.63	8.85%
Gansu Province	2577.55	1060	87.26	1147.26	44.51%
Baiyin Municipality	174.3	45.29	7.47	52.76	30.27%
Jingyuan County	48.11	16.15	0.79	16.94	35.21%

8.2 Poverty Reduction Strategy and Measures

173. In governmental statistics, the poor population is divided into rural poor population and urban low-income population, and poverty reduction strategies and measures for them are not entirely the same.

174. In August 2012, the State Council approved the Development and Poverty Reduction Plan for the Liupanshan Contiguous Destitute Region (2011-2020), proposing specific measures for infrastructure construction, industrial development, rural production and living conditions, employment and rural human resources development, social development and public services, ecological construction and environmental protection, etc. Some measures proposed under the Project are consistent with the measures of industrial development, employment and rural human resources development, and rural labor quality improvement in this plan.

175. In September 2013, the Gansu Provincial Government promulgated "Opinions on the Implementation of the 1236 Poverty Reduction Action". "1" stands for "increasing the income of the poor population continually"; "2" for "providing poor population with sufficient food and clothing"; "3" for "providing compulsory education, basic medical care and housing"; and "6" for making 6 breakthroughs in infrastructure construction, industrial development, and resettlement for poverty reduction, financial support, public service security, and competence improvement. The Project is directly associated with industrial development and competence improvement in the Opinions.

176. In addition, the local poverty reduction strategy for urban low-income population is to accelerate local economic transformation to generate more job opportunities, and improve the social security system for urban residents. The Project is consistent with this strategy.

8.3 Impacts of the Project on Poverty Reduction

177. Based on poverty reduction experience and lessons of the PRC and the world, the most important measure for effective poverty reduction is to enable poor population to be employed effectively, and receive better education or skills training. The Project will cover both aspects.

178. As described above, about 92,000 new permanent jobs and 70,000 temporary jobs in total will be generated during LIP construction and operation. Baiyin Municipality has an urban unemployed or semi-unemployed population of about 69,000, a recessively unemployed population of 20,000, and rural surplus labor of 150,000, totaling 240,000. This means that the new jobs generated during LIP construction and operation may provide employment to Baiyin Municipality's current urban and rural surplus labor.

179. In Baiyin Municipality, the average daily pay of unskilled labor is about CNY80, and that of skilled labor not less than CNY100. Based on the lowest pay, each laborer will receive a wage income of not less than CNY2,400 per month. If 50% of Baiyin Municipality's urban and rural surplus labor works in LIP, the total annual income of this population will be about CNY3.5 billion.

180. Baiyin Municipality's urban poor population is composed of laid-off workers, and mainly unemployed or semi-unemployed population. The main causes of poverty of the rural poor population are harsh natural conditions and frequent natural disasters. Therefore, for both urban and rural poor population, the most important measure for poverty reduction is to provide continuous and stable jobs. The Project and LIP served by it will undoubtedly play this role.

181. Most enterprises to settle in LIP are capital-intensive large and medium heavy chemical enterprises, and jobs offered by them are highly skilled. This means that not all urban and rural surplus laborers can work in the enterprises in LIP successfully, and such factors as age, gender and vocational skills are involved in this respect. However, the Technical and Vocational Education and Training component of the Project will strengthen labor skills of the poor population through vocational training, and increase their probability of employment.

182. It should be noted that new jobs generated by the Project and LIP may suit the poor population of different ages and genders differently. The existing enterprises in LIP generally require laborers aged 18-45 years, while over 50% of local surplus laborers are aged above 45 years who were the most important wage earners in their families. In view of this, the LMC and local labor and social security departments should require the enterprises offer a certain number of jobs to surplus labor aged above 45 years through consultation.

Table 53: Transfer, Output and Training of Urban and Rural Surplus Labor of Baiyin Municipality in 2012 (0,000)

		Baiyin District	Pingchuan District	Huining County	Jingyuan County	Jingtai County	Total
Mode of transfer and output	Organized	1.32	1.77	6.2	5.7	2.52	17.51
	Personal	0.91	1.03	4.4	3.73	3.06	13.13
Direction of transfer and output	In the province	1.81	2.11	5.96	7.18	4.3	21.36
	Out of the province	0.42	0.68	4.76	2.25	1.28	9.39
	Overseas	0	0	0.02	0.02	0.01	0.05
Number of persons trained	Total	1.50	0.9	7.02	4.85	1.98	16.25
	- Orientation training	1.24	0.56	5.78	3.7	1.37	12.65
	- Skills training	0.26	0.34	1.24	1.15	0.61	3.6

Source: Statistical Yearbook 2013 of Baiyin Municipality

9 Social and Gender Analysis

9.1 Social and Gender Development of the Project Area

183. According to the Statistical Yearbook 2013 of Gansu Province, Baiyin Municipality had a resident population of 1.7192 million in 2012, of which 48.62% were female.

184. Over these years, the protection of women's rights and interests, and their development have been generally very good in Baiyin Municipality, with little differences between men and women in most areas. For example, in 2012, all rural school-age children in Baiyin Municipality received primary education regardless of gender. In addition, a health center for women and children has been established in each township, rural basic medical insurance covers over 95% of rural residents including women, and urban basic medical insurance covers over 95% of urban residents including women.

185. However, there are larger gender differences in certain aspects for traditional and realistic reasons. For example, in Baiyin Municipality, 70% of all community members are women, yet only 14% of all village community committee members are women. Similarly, not more than 15% of leadership members of governments and functional departments at or above the township level are women.

186. Whether in urban or rural areas, women are highly involved in production and employment, without any cultural or social obstacle. For example, in Baiyin Municipality in 2012, 48.2% of rural employees were women, almost equivalent to the percentage of female population of 48.62%. However, it cannot be ignored that since women often assume the responsibility of taking care of family members and women are relatively weak in physical strength, recessive employment discrimination does exist in the labor market, such as unequal pay for equal work, and whole or partial exclusion of women to certain jobs.

187. Gender quality is a basic national policy. As early as 1992, the Chinese government promulgated the Law of the People's Republic of China on the Protection of Rights and Interests of Women and Children to protect women's equal political, economic, cultural, social and living rights, and their special rights and interests, such as paid leave during childbirth, and prohibit discriminating, mistreating and harming women. Correspondingly, local governments have enacted local regulations on the protection of rights and interests of women and children.

188. In order to promote the implementation of the Law on the Protection of Rights and Interests of Women and Children, the Chinese government promulgated the Outline of the Chinese Program for the Development of Women and Children (2011-2020) in July 2011. The outline established the rationale, objectives and measures for the protection of women and children in the next decade, and required that gender quality should be ensured in the 7 major aspects of health, education, economy, decision-making and management, social security, environment, and law.

189. In December 2011, the Baiyin Municipal Government promulgated the Women's Development Plan of Baiyin Municipality (2011-2020), proposing specific development objectives and strategies in respect of women and health, women and education, women and economy, women's participation in decision-making and management, women and social security, women and environment, and women and law to promote women's development and gender equality. The important objectives include:

(1) Ensuring that boys and girls have equal rights, opportunities and resources of education, and over 95% of young women receive senior high school education;
(2) Ensuring that over 45% of employees are women, reducing income gaps between male and female labor, improving labor skills of female labor, reducing the

incidence of occupational diseases of female labor, and ensuring that men and women enjoy the same level of protection of labor rights and interests;

(3) Increasing women's percentage and improving their ability to participate in decision-making and management, including increasing women's percentage in members of people's congresses, political consultative conferences and government departments at all levels;
(4) Realizing full coverage of maternity and medical care for women; and
(5) Realizing a centralized water supply rate of over 85% in rural areas to improve women's health.

190. In order to realize the above objectives, the plan also proposes specific measures, such as

(a) increasing investment in public health for women, and in women's vocational education and training,
(b) eliminating gender discrimination in employment,
(c) protecting women's labor rights and interests,
(d) providing small-amount loans for employment and business startup to women, and
(e) defining minimum percentages of women in the leadership and staff of government departments etc.

191. In addition, Baiyin Municipal and Jingyuan County Women's Federations will coordinate with BPMO and LMC to assist in organizing several consultative, advocacy, and training activities for each subcomponent.

Table 54: Female Population of the Project Area (10,000)

Division	Year-end resident population	Among whom	
		Females	Percent of females
Lanzhou Municipality	363.05	177.35	48.85%
Baiyin Municipality	171.92	83.59	48.62%
Baiyin District	29.73	14.29	48.07%
Pingchuan District	19.38	9.18	47.37%
Jingyuan County	45.91	22.40	48.79%
Huining County	54.55	26.77	49.07%
Jingtai County	22.35	10.94	48.95%

Table 55: Economic and Social Development Indicators of the Project Area by Gender

Indicator		Unit	Baiyin Municipality	Baiyin District	Pingchuan District	Jingyuan County	Huining County	Jingtai County
Rural children of school age		0,000	9.99	0.35	0.54	2.93	5.05	1.12
Among whom	Male	0,000	5.33	0.19	0.28	1.54	2.71	0.61
	Female	0,000	4.66	0.16	0.26	1.39	2.34	0.51
Enrollment rate of rural children of school age		0,000	9.99	0.35	0.54	2.93	5.05	1.12
Among whom	Male	0,000	5.33	0.19	0.28	1.54	2.71	0.61
	Female	0,000	4.66	0.16	0.26	1.39	2.34	0.51
Rural employees		0,000	71.12	3.42	5.22	22.41	29.34	10.73
Among whom	Male	0,000	36.78	1.84	2.71	11.59	15.09	5.55
	Female	0,000	34.34	1.58	2.51	10.82	14.25	5.18
Workforce of community committees		/	1,273	382	625	105	55	106
Among whom: Female		/	891	277	426	78	36	74
Workforce of village committees		/	3,313	207	289	703	1,456	658
Among whom: Female		/	472	41	37	66	267	61

9.2 Social and Gender Development Issues in the Project

192. 40.3% of the respondents are female. Among the female respondents, 20% do part-time jobs, 34.2% do part-time jobs and 46% are unemployed, while these percentages are 21.3%, 40.2% and 38.5% among the male respondents. The survey shows that the percentage of the male respondents who have been employed before (15.5%) is slightly higher than that of the female respondents (22.4%), while there is no significant difference in places of work.

Table 56: Past Employment Experience

	Yes	No
Male	15.5%	84.5%
Female	22.4%	77.6%
Total	18.3%	81.8%

Table 57: Places of Most Recent Jobs

	Urban area of Baiyin Municipality	Remainder of Baiyin Municipality	Remainder of the province	Out of the province
Male	57.2%	38.3%	1%	3.5%
Female	54.4%	38.4%	5.6%	1.6%
Total	56.1%	38.3%	2.8%	2.8%

193. Among the female respondents who have been employed before, the pay of the most recent job ranges from CNY3,500 to 400/month, with an average of CNY1,587/month and a standard deviation of CNY663. Among the male respondents who have been employed before, the pay of the most recent job ranges from CNY18,000 to CNY700/month, with an average of CNY2,060/month and a standard deviation of CNY1,359. This shows significant differences in pay level between men and women.

Table 58: Pay of Most Recent Job (CNY)

	Males	Females
Valid samples	202	125
Minimum	700	400
Maximum	18,000	3,500
Mean	2,060.43	1,587.42
Standard deviation	1,358.91	663.15

194. Among causes of unemployment, 30% of the female respondents choose having to take care of family members, while this percentage is only 5% among the male respondents; 28% of the male respondents choose low pay, while this percentage is only 19.3% among the female respondents. Among the unemployed respondents, 37.9% of the males have durations of unemployment of not more than 3 months, while this percentage is 29.3% among the female respondents. 17.8% of the males have durations of unemployment of not more than half a year, while this percentage is 20% among the females. 11.9% of the males have durations of unemployment of not more than one year, while this percentage is 6% among the females. 32.4% of the males have durations of unemployment of one year or more, while this percentage is 44.7% among the females. This shows that durations of unemployment of the females are generally lower than those of the males.

Table 59: Causes of Unemployment

	Primary cause			Secondary cause		
	Male	Female	Total	Male	Female	Total
Physical health	10.6%	6.7%	9%	6.5%	10.3%	8.1%
Incompetence	7.3%	12%	9.2%	8.1%	4.6%	6.6%
Staff reduction or closedown	22.9%	22%	22.6%	8.9%	8%	8.5%
Having to take care of family members	5%	30%	15.2%	6.5%	19.5%	11.8%
Low pay	28%	19.3%	24.5%	36.3%	33.3%	35.1%
Wanting to find a new job	6.4%	4%	5.4%	18.5%	16.1%	17.5%
Wanting to rest for some time	3.2%		1.9%	9.7%	6.9%	8.5%

Other	16.5%	6%	12.2%	5.6%	1.1%	3.8%

Table 60: Duration of Unemployment

	Not more than 3 months	Not more than half a year	Not more than one year	One year or more
Male	37.9%	17.8%	11.9%	32.4%
Female	29.3%	20%	6%	44.7%
Total	34.4%	18.7%	9.5%	37.4%

195. During unemployment, 32.5% of the female respondents do nothing at home or do odd jobs, while this percentage is 30% among the male respondents. 27.2% of the female respondents take care of family members, while this percentage is 6.9% among the male respondents. 23.5% of the male respondents are finding a new job, while this percentage is 8.6% among the female respondents.

Table 61: Main Activities during Unemployment

	Primary cause			Secondary cause		
	Male	Female	Total	Male	Female	Total
Doing nothing at home	9.2%	13.2%	10.9%	1%	1%	1%
Doing odd jobs occasionally	30%	32.5%	31%	11.4%	10.7%	11.1%
Taking care of family members	6.9%	27.2%	15.2%	6.7%	29.1%	17.8%
Doing farm work	18%	15.2%	16.8%	9.5%	22.3%	15.9%
Finding a new job	23.5%	8.6%	17.4%	55.2%	29.1%	42.3%
Learning new skills and knowledge	3.2%	1.3%	2.4%	12.4%	5.8%	9.1%
Other	9.2%	2%	6.3%	3.8%	1.9%	2.9%

196. Among the unemployed respondents, 46.3% of the males expect to work in the county, while this percentage is 53.9% among the females; 41% of the males expect to work in the remainder of Baiyin Municipality, while this percentage is 39% among the females. It can be seen that 86.3% of the males expect to work in Baiyin Municipality, while this percentage is 92.9% among the females. This means that most of the unemployed respondents prefer working locally, especially the males. Among the unemployed respondents, 54.7% of the females expect to work in LIP, while this percentage is 55.2% among the males, 38.1% of the males and 31.7% of the females will depend, and only 6.7% of the males and 13.7% of the females will not work in LIP. There is no significant gender difference in working in LIP.

Table 62: Expected Places of Employment

	Male	Female	Total
In the county	46.3%	53.9%	49.3%
Remainder of Baiyin Municipality	41%	39%	40.2%
Lanzhou Municipality	1.7%	1.9%	1.8%
Remainder of Gansu Province	1.3%	0.6%	1%
Anywhere	9.6%	4.5%	7.6%

Table 63: Are you willing to work in LIP?

	Willing	Unwilling	Do not know; Depends
Male	55.2%	6.7%	38.1%
Female	54.7%	13.7%	31.7%
Total	55%	9.5%	35.5%

197. 82.8% of the male respondents and 83.1% of the female respondents think that pay level is the primary factor for reemployment, followed by type of work and distance from the workplace. 62.3% of the female respondents expect a monthly pay of CNY2,001-3,000, while this percentage is only 37.9% among the male respondents. 15.5% of the female respondents expect a monthly pay of CNY3,001-4,000, while this percentage is 37.9% among the male respondents. 16.2% of the female respondents expect a monthly pay of CNY1,001-2,000, while this percentage is 6% among the male respondents. In addition, 18.1% of the male respondents expect a monthly pay of CNY4,000, while this percentage is 3.9% among the female

respondents. This shows that the overall pay level expected by the male respondents is higher than that expected by the females.

Table 64: Factors Affecting New Jobs

	Primary factor			Secondary factor		
	Male	Female	Total	Male	Female	Total
Pay	83.2%	83.1%	83.2%	3.2%	2.1%	2.8%
Hazards	7.8%	4.5%	6.5%	29.6%	25.5%	28%
Distance from home	3%	3.9%	3.4%	8.8%	15.9%	11.6%
Overtime	0.4%	1.9%	1%	2.8%	3.4%	3%
Social security	1.7%	3.9%	2.6%	40.7%	38.6%	39.9%
Interest in the job	0.9%	0%	0.5%	2.8%	0.7%	1.9%
Learning new skills and knowledge	1.7%	1.3%	1.6%	3.7%	2.1%	3%
Development opportunities	1.3%	1.3%	1.3%	7.9%	11%	9.1%
Making new friends	0%	0%	0%	0.5%	0.7%	0.6%

Table 65: Expected Pay of New Job

	Male	Female	Total
CNY1,001-2,000	6%	16.2%	10.1%
CNY2,001-3,000	37.9%	62.3%	47.7%
CNY3,001-4,000	37.9%	17.5%	29.8%
CNY4,001-5,000	11.6%	2.6%	8%
CNY5,001-6,000	5.2%	1.3%	3.6%
CNY6,001-7,000	0.9%	0%	0.5%
CNY7,001 or above	0.4%	0%	0.3%

198. The male and female respondents differ slightly in unemployment duration and expectations in general, and differ slightly in the protection of labor rights and interests.

199. 87.9% of the male respondents and 89.4% of the female respondents know a little about the Labor Law; 10.5% of the male respondents and 8.7% of the female respondents know some details of the Labor Law. 80.3% of the male respondents and 82% of the female respondents know little about social insurance and housing fund; 16.3% of the male respondents and 16.1% of the female respondents know some details. The above data shows no significant gender difference.

Table 66: Awareness of the Labor Law

	Male	Female	Total
Never heard of	1.7%	1.9%	1.8%
Know a little	87.9%	89.4%	88.5%
Know some details	10.5%	8.7%	9.8%

Table 67: Awareness of Social Insurance and Housing Fund

	Male	Female	Total
Never heard of	3.3%	1.9%	2.8%
Know a little	80.3%	82%	81%
Know some details	16.3%	16.1%	16.3%

200. Similarly, there is no significant gender difference in concrete actions that reflect the protection of labor rights and interests. 41.8% of the male respondents and 41% of the female respondents are unwilling to work overtime, 39.3% of the male respondents and 44.7% of the female respondents will depend, while 18.4% of the male respondents and 13% of the female respondents are willing to work overtime. 38.1% of the male respondents and 37.3% of the female respondents are unwilling to do hazardous jobs; 47.7% of the male respondents and 43.5% of the female respondents are willing with protective measures and high pay only. Among the respondents who have been employed before, 56.5% of the males and 57.2% of the

females did not sign a labor contract; and 63% of the males and 64.4% of the females did not cover labor insurance.

Table 68: Are you willing to work overtime?

	Willing	Unwilling	Depends	Do not know
Male	18.4%	41.8%	39.3%	0.4%
Female	13%	41%	44.7%	1.2%
Total	16.3%	41.5%	41.5%	0.8%

Table 69: Are you willing to do a dangerous job?

	Male	Female	Total
Willing without protective measures as long as pay is high	1.3%	0.6%	1%
Willing with protective measures only	9.6%	13%	11%
Willing with protective measures and high pay	47.7%	43.5%	46%
Unwilling	38.1%	37.3%	37.8%
Depends	3.3%	5.6%	4.3%

Table 70: Did you sign a labor contract in past employment?

	Yes	No
Male	43.5%	56.5%
Female	42.8%	57.2%
Total	43.2%	56.8%

Table 71: Did you cover labor insurance in past employment?

	Yes	No
Male	37%	63%
Female	35.6%	64.4%
Total	36.4%	63.6%

10 Ethnic Minorities

201. According to the data of the sixth national census in 2010, the PRC's population was 1.333 billion in 2010, including a Han population of 1.221 billion and a minority population of 112 million, accounting for 8.4%. In 2010, Gansu Province had a population of 25.5753 million, including a Han population of 23.1648 million, accounting for 90.57%; and a minority population of 2.4105 million, accounting for 9.43%. At the end of 2012, Gansu Province had a resident population of 25.1212 million, including a Han population of 22.937 million, accounting for 91.31%, and a minority population of 2.1842 million, accounting for 8.69% (this percentage is equivalent to the national average).

202. In Gansu Province, the minority population is distributed in Linxia Prefecture, Gannan Prefecture, Tianshui Municipality, Pingliang area, Lanzhou Municipality and Wuwei area mainly, and this is mostly Hui, accounting for over 60% of the province's minority population. In 2012, Baiyin Municipality's minority population accounted for only 1.22% of the province's minority population.

Table 72: Han and Minority Populations in the Project Area (2012)

Division	Gross population (10,000)	Han people		Ethnic minorities		Percentage to provincial minority population	Percentage to Baiyin City's minority population
		Population (10,000)	Percentage to gross population	Population (10,000)	Percentage to gross population		
Gansu Province	2512.12	2293.7	91.31%	218.42	8.69%	100%	-
Lanzhou Municipality	314.25	301.7	96.01%	12.52	3.99%	5.73%	-
Jiayuguan Municipality	15.96	15.6	97.82%	0.35	2.18%	0.16%	-
Jinchang Municipality	45.19	44.6	98.64%	0.61	1.36%	0.28%	-
Baiyin Municipality	**171.97**	**169.3**	**98.45%**	**2.67**	**1.55%**	**1.22%**	**100%**
Baiyin District	*27.46*	*27.0*	*98.34%*	*0.46*	*1.66%*	-	*17.07%*
Pingchuan District	*18.64*	*18.4*	*98.44%*	*0.29*	*1.56%*	-	*10.91%*
Jingyuan County	*46.31*	*45.8*	*98.91%*	*0.51*	*1.09%*	-	*18.93%*
Huining County	*56.86*	*55.6*	*97.83%*	*1.23*	*2.17%*	-	*46.16%*
Jingtai County	*22.70*	*22.5*	*99.19%*	*0.18*	*0.81%*	-	*6.93%*
Tianshui Municipality	321.68	299.1	92.99%	22.56	7.01%	10.33%	-
Jiuquan area	98.05	95.3	97.23%	2.72	2.77%	1.24%	-
Zhangye area	125.16	122.5	97.91%	2.61	2.09%	1.19%	-
Wuwei area	183.69	174.7	95.09%	9.03	4.91%	4.13%	-
Dingxi area	281.96	279.1	98.98%	2.89	1.02%	1.32%	-
Longnan area	258.61	253.4	97.97%	5.24	2.03%	2.4%	-
Pingliang area	206.60	192.0	92.94%	14.59	7.06%	6.68%	-
Qingyang area	242.06	241.5	99.76%	0.57	0.24%	0.26%	-
Linxia Prefecture	182.93	78.2	42.72%	104.78	57.28%	47.97%	-
Gannan Prefecture	64.00	26.7	41.75%	37.28	58.25%	17.07%	-

Source: Website of the Gansu Provincial Government

203. In 2012, Baiyin Municipality had a resident population of 1.7197 million, including a Han population of 1.693 million, accounting for 98.45%, and a minority population of 26,700, accounting for 1.55%. Hui population accounts for over 90% of the municipality's minority

population. Huining County's minority population accounts for 46.16% of the municipality's minority population. In addition, the minority population of Jingyuan County and Baiyin District accounts for 18.93% and 17.07% of the municipality's minority population respectively.

204. The minority population of Baiyin District is distributed mainly in the urban area, and only accounts for 1.66% of the district's population. In 2012, Jingyuan County had a resident population of 463,000, including a Han population of 458,000, accounting for 98.91% of the county's population, and a minority population of 5,051, accounting for 1.09% of the county's population. The minority population of Jingyuan County is distributed in the northeast mainly, and there is no minority population in the two villages within the planning area of LIP.

205. Minority population scattered in the urban area or living together in remote mountain areas has few differences from the mainstream population in terms of social welfare, rights, security, customs and language. Although a very small minority population is scattered in the project area, the Project will have no negative impact on minority population.

Table 73: Identification Form of Ethnic Minorities

Impact on ethnic minorities	Unclear	Yes	No	Remarks
Is there any ethnic minority in the project area?		Y		Scattered
Does this ethnic minority maintain unique customs and economic patterns, and is therefore disadvantaged?			Y	
Will the Project restrict their economic and social activities, and make them disadvantaged gradually?			Y	
Will the Project change their economic, social and cultural institutions?			Y	
Will the Project disturb their regular community life?			Y	
Will the Project have any positive impact on their health, education, livelihoods or social security?		Y		
Will the Project have any negative impact on their health, education, livelihoods or social security?			Y	
Will the Project change or weaken their traditional self-perceptions, customs and cultural traditions?			Y	

11 SOCIAL DEVELOPMENT ACTION PLAN

11.1 GENDER ACTION PLAN

206. The Gender Action Plan (GAP) is in Linked Document 9.

11.2 SOCIAL DEVELOPMENT ACTION PLAN (including Public Participation Plan)

207. The Social Development Action (SDAP) is in Supplementary Document 5.

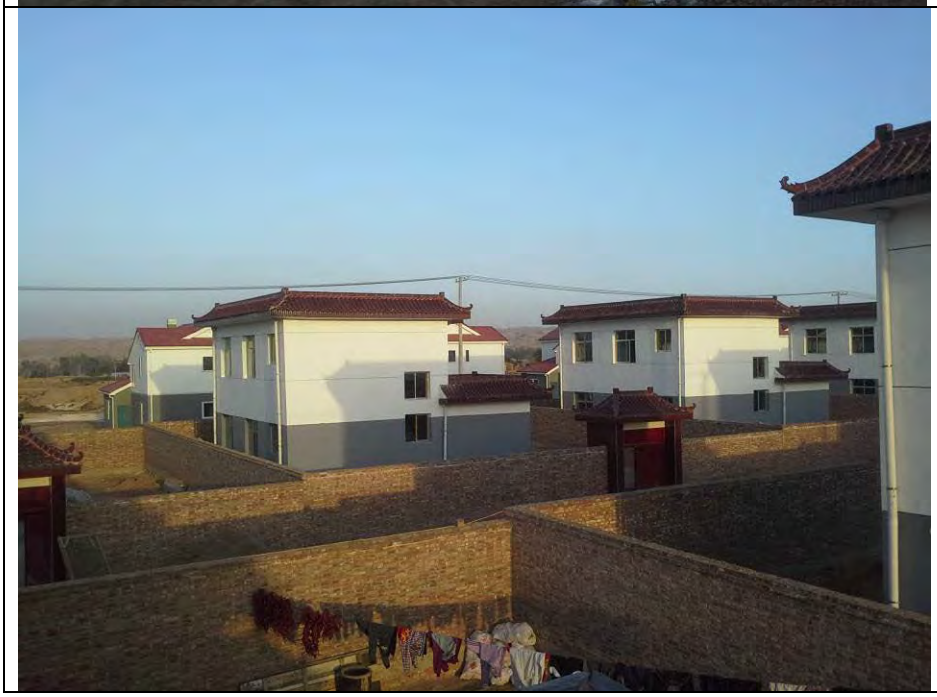
11.3 Monitoring and Implementation

208. In order to ensure that the PMO implements the SDAP and GAP during project implementation, monitoring indicators were fully discussed with related agencies and formulated in the SDAP and GAP. Moreover, a comprehensive PPMS framework, including the social and gender monitoring indicators, has also been developed to systematically generate data in the social and gender aspects in consultation with the implementing agency, and with the assistance of consultants.

209. During the project implementation, the PMO will assign staff, or contract consultants, to collect baseline and progress data at the requisite time intervals, including annual reporting. The PMO will be responsible for analyzing and consolidating reported data through its management information system, and reporting outcomes to ADB through quarterly progress reports.

210. The monitoring indicators for the SDAP and Social and Gender Development Plan are included in the PPMS. During the implementation of the Project (2013-2018), a PPMS monitoring and evaluation report will be submitted annually.

Attachment: Relevant Photos

	Basic landform of the project area
	Resettlement community under construction
	Completed resettlement housing

	A newly introduced enterprise whose production workshop is under construction
	A newly introduced enterprise whose production workshop is under construction
	Current situation of the LIP construction site

	A trunk road in LIP under construction
	Enrollment publicity vehicle of a vocational school in the Jingyuan county town
	Recruitment notice of Gansu Kaisi Porcelain Industry Co., Ltd. newly introduced into LIP

	FGD in Xijie Community, Chengguan Town, Jingyuan County
	FGD in Nanshanwei Village, Liuchuan Township, Jingyuan County
	FGD in Xintian Village, Santan Township, Jingyuan County

	Institutional interview with the Baiyin Municipal Labor and Social Security Bureau
	FGD with representatives from relevant departments of the Jingyuan County Government

SUPPLEMENTARY DOCUMENT 5
SOCIAL DEVELOPMENT ACTION PLAN

Actions or activities	Target and indicators	Responsible Agencies	Timeline	Budget and cost
A. LIP Infrastructure Improvement				
Whole LIP		**Responsible agencies**: Baiyin PMO, construction bureau, design agency, LMC, planning bureau, price bureau **Assisting agencies**: Health bureau, environmental protection bureau, women's federation, poverty alleviation office, transport bureau	2015-2019	LIP development budget of the local government, the project detailed design cost
● Provide necessary public service facilities in LIP by Jingyuan County Government as residential needs, such as schools, hospitals, commercial properties etc. ● Buses from LIP to the urban area and county town are serviceable ● Construct public rental houses for migrant labor, graduated students and poor employees	● All potential employees and residents in LIP ● Satisfaction level of employees and residents in LIP with public service facilities is not less than 70%. ● Number of public rental houses constructed ● 30% of laborers who live in the public rental houses are poor.			
Roads				
● Improve design on bicycle lanes, sidewalks, crosswalks, street lights, bus stops and traffic signals and other traffic facilities on roads, and sett up warning signs or isolation facilities for section with many heavy industrial vehicles ● Traffic safety awareness education program for residents of Baiyin City and Jingyuan County	● Satisfaction level of residents in LIP is not less than 80% and new roads are functional and sound. ● 30% of attendees to traffic safety awareness campaigns are poor.			
Water Supply and wastewater treatment				
● Public hearing for water supply and wastewater treatment tariff in Jingyuan County	● Number of public hearings held ● Poor representatives are elected (sex disaggregated). ● Poor representatives collect comments from focus group discussion of community based poor groups			
B. LIP community management				
● Prepare LIP community management scheme with participation of poor people ● Give training program to the staff of the LIP Community Management Department at least twice a year	● 30% poor participants in LIP community management scheme preparation ● Frequency of training programs (sex disaggregated)	**Responsible agency**: LMC **Assisting agency**: Baiyin PMO	2015-2019	LIP operational funds
C. Establishing a public consultation and participation mechanism				
● Disclose LIP master plan and project information to	● At least 70% of residents around LIP	**Responsible agencies**:	2015-	Project

local residents and employees in LIP ● Public hearings are held for transportation, water supply, and wastewater tariff, attended by representatives of the poor.	(four townships) are informed, of which 30% are poor; ● Number of public hearings ● Number of poor representatives	Baiyin PMO, LMC **Assisting agencies**: Civil affairs bureau, communities, price bureau, women's federation, poverty alleviation office	2019	preparation budget, government funds
D. Vocational education and training				
County secondary TVET school meets skill set needs of new and emerging industries in LIP.	● At least 200 students enrolled by the end of Year 5, employment rate increased from 70% to 90% ● Number of newly hired teachers (at least one dual qualified teacher) ● All teachers in the new subject and representatives from enterprises participate in CBT and teaching-learning development activities.	**Responsible agency**: Jingyuan County Secondary TVET School **Assisting agencies**: Baiyin PMO, LMC, municipal education bureau, municipal and county labor and social security bureaus	2015-2019	Budget from capacity building component, and local government funds
Relocated farmers, agricultural workers, unemployed workers and surplus labor groups have more access to training and employment opportunities.	● At least 1,000 trainees enrolled for 3 existing and 5 new short-term training courses by the end of Year 5 ● Number of instructors participating in CBT and teaching-learning development activities ● Numbers of instructors, assessors, and management staff that receive training	**Responsible agencies**: County labor and social security bureau, Jingyuan County Secondary TVET School **Assisting agencies**: Baiyin PMO, LMC, municipal education bureau, municipal labor and social security bureau, pertinent enterprises	2015-2019	
Match labor market demand and supply information for effective employment service	● Labor market information software developed or procured ● Number of local people accessing and benefiting from career guidance services (sex disaggregated) ● Employment promotion program implemented (sex disaggregated)	**Responsible agencies**: Municipal and county labor and social security bureaus **Assisting agencies**: Baiyin PMO, LMC		
E. Baiyin intelligent transport management systems				
● Provide subsidies for use of the public transport to vulnerable groups, e.g. disabled, old people, school age students	● Number of subsidized disabled, old people and students ● Amount of subsidies	**Responsible agencies**: Baiyin PMO, municipal traffic police detachment **Assisting agencies**:	2015-2019	Local government funds

		Communities, mass media, women's federation		
F. Generating job opportunities				
1. Job opportunities generated by project and enterprises in LIP ● Generate skilled and unskilled jobs at the construction stage	● 131 skilled and 150 unskilled jobs generated at the construction stage (30% of which are first made available to the poor)	**Responsible agencies**: Baiyin PMO, LMC, enterprises in LIP **Assisting agencies**: Civil affairs bureau, contractors, labor and social security bureaus, poverty alleviation office	2015-2018	Project construction and operation funds, construction and operation costs of enterprises in LIP
● Generate skilled and unskilled jobs at the operation stage ● Generate job opportunities by attracting enterprises to locate in LIP	● 75 skilled and 31 unskilled jobs generated at the operation stage (30% of which are first made available to the poor) ● About 77,859 jobs generated by enterprises in LIP and 8,392 jobs created from the services sector in LIP ● 30% of jobs provided to the poor			
2. Protection of labor rights and interests of employees in LIP ● Conduct knowledge campaign on the Labor Law ● Sign labor contracts with employees in LIP ● Provide health and labor protection measures to employees in LIP	● 90% of employees in LIP are aware of the Labor Law. ● 90% of employees in LIP sign labor contracts. ● Protection measures are provided to not less than 95% of employees in LIP. ● Employees are paid on time and in full.	**Responsible agencies**: Baiyin PMO, labor and social security bureau **Assisting agencies**: LMC, enterprises in LIP	2015-2019	Local government finance
G. Health publicity and HIV/AIDS prevention education				
● Include HIV/AIDS and other communicable disease clauses into contract bidding documents ● Public health and HIV/AIDS prevention education conducted to civil works contractors and LIP employees ● Health measures for construction workers (e.g., setup of a temporary infirmary, use of local medical resources) are established. ● Conduct diversified publicity activities on HIV/AIDS, e.g. brochures, posters and picture albums	● Terms of construction contracts and implementation ● Public health and HIV/AIDS prevention training courses and number of trainees ● Number of health measures ● Forms of publicity on HIV/AIDS prevention at the construction stage, e.g. number of brochures, posters and picture albums distributed	**Responsible agencies:** LMC, contractors, local sanitation agencies **Assisting agencies: Baiyin** PMO, communities, enterprises, women's federation	2015-2017	Funds under the construction contract, budget of the sanitation agency (CNY20,000/ year)

BPMO = Baiyin Municipal project management office, CBT= competency-based training, CNY = Yuan, LIP = Liuchuan Industrial Park, LMC = Liuchuan Industrial Park Management Committee, TVET = technical and vocational education and training

Source: TA Consultants' estimates

SUPPLEMENTARY DOCUMENT 6

PRIVATE PUBLIC PARTNERSHIP

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ABBREVIATIONS

ADB	Asian Development Bank		PMO	Project Management Office
BOT	Build–Operate–Transfer		PPTA	Project Preparatory Technical Assistance
CNY	China Yuan (Chinese currency)		PRC	People's Republic of China
COD	Chemical Oxygen Demand		PS	Pumping Station
DB	Design Build		PPP	Public Private Participation
DBO	Design-Build-Operate		RMB	Renminbi (Chinese currency)
DBOF	Design-Build-Operate-Finance		TA	Technical Assistance
FSR	Feasibility Study Report		TOR	Terms of Reference
LIP	Liuchuan Industrial Park		TOT	Transfer-Operate-Transfer
LIPMC	Liuchuan Industrial Park Management Committee		TVET	Technical and vocational education and training
lpcd	liter per capita per day		USD	United States Dollar
ITS	Intelligent Traffic System		WB	World Bank
JWWSP	Jingyuan Wujiawan Water Supply Plant		WSP	Water Supply Plant
O&M	Operation and Maintenance		WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Public-Private Partnership (PPP) involves a transaction based on contractual agreements between a public agency and a private sector partner that enables the particular skills and assets of each participant (public and private) to be shared in delivering a service or facility for the use of the general public, while also appropriately allocating risks and rewards. PPP project structures allow for greater private sector participation in the financing and delivery of projects and typically offer incentives for efficiency and innovation in project finance and delivery. The objective of this study is to find out appropriate PPP scheme for water and wastewater services in Liuchuan Industrial Park (LIP).

The Challenges LIP facing for Management of Water/Wastewater Facilities include:

- Uncertainties in development
- Lack of Professional Resources and Support
    - Lack of Risk Management experience and mechanism
    - Lack of funding for future development

The Needs of water/wastewater facilities management in LIP are:

- The water and waste water facilities to be built in LIP need an experienced operation and management team to serve the industrial customers. This includes minimum interruption of water supply, emergency response to accidents, active leakage reduction, etc.
- As there is uncertainties in the development of LIP and Jingyuan Water Supply and Drainage Company lack of experiences in dealing with those uncertainties, LIP needs an experienced operator to share the operational risks.
- The ownership of the proposed water and wastewater facilities should belong to LIP or Jinyuan government. Any change or transfer of ownership of assets financed by Asian Development Bank (ADB) must be approved by ADB.
- LIP will need leverage owned asset to finance future new investment (such as: sludge disposal facilities, water distribution pipelines, brunch sewers, upgrading or expansion of the Water or Wastewater Treatment Plants

Based on challenges LIP is facing and its development needs, 5 PPP Options are developed under this study:

- Option 1 – Design – Build – Operation (DBO)
- Option 2 – O&M (operator to collect tariff from customer)
- Option 3 – O&M (LIP to collect tariff from customer)
- Option 4 – O&M W/WWTP + BOT on new facilities
- Option 5 – Lease

These five options are compared by their financial viability, technical and operational feasibility and their cost efficiency (Table A).

Table A: Comparison of PPP Options

No.	PPP Option	Finance	Risks/Cost			Value for Money (VFM)
			Technical		Operational	
			Design	Construction		
1	Design-Bid-Operate-Maintain (DBOM)	1. Borrowing money for construction (Procuring and labor costs). 2. Working Capital during operations period	Full responsibility (under defined responsibilities and obligations in the contract)		Full responsibility (under defined responsibilities and obligations in the contract)	1. Lower bid price gained from competition and less margin on each vendor's bid 2. Optimize the OPEX during the operations period. 3. Seamless transfer of risks from Design & Build phase to Operate.
2	Operations and Maintenance (O&M) with billing and collection services	Working Capital during operations period	No design risk/cost	No construction risk/cost	Full responsibility (under defined responsibilities and obligations)	1. Optimize the OPEX during the operation period. 2. Costs are highly transparent. 3. Optimize the value of assets by renewal of the facilities.
3	Operations and Maintenance (O&M)	Working Capital during operation period	No design risk/cost	No construction risk/cost	Full responsibility (under defined responsibilities and obligations)	1. Optimal the Opex during the operation period. 2. Costs are highly transparent. 3. Optimal the value of assets by renewal of the facilities.

No.	PPP Option	Finance	Risks/Cost			Value for Money (VFM)
			Technical		Operational	
			Design	Construction		
4	O&M (BOT future extension)	Working Capital during operation period except future investment	No design risk/cost	No construction risk/cost	Full responsibility (under defined responsibilities and obligations)	1. Optimal the Opex during the operation period. 2. Costs are highly transparent. 3. Optimal the value of assets by renewal of the facilities.
5	Lease	Working Capital during operation period and lease fee	No design risk/cost except latent defects	No construction risk/cost except latent defects	Full responsibility (under defined scopes, responsibilities and obligations); Demand risks; Tariffs collective risks;	1. Optimal the Opex during the operation period. 2. Costs are highly transparent. 3. Optimal the value of assets by renewal of the facilities. 4. Shift the demand risk.

DBO = Design-Build-Operate; BOT = Build-Operate-Transfer; Opex = Operations Expenses

To address LIP's needs, Option 1 - DBO procurement scheme will be the most appropriate solution to fulfill needs of the construction and operation of the facilities in LIP. In DBO contract, the contractor will be responsible for the design, construction and operation of the facility and also bear the technical and operational risk during the contract period. In addition, when design, construction and operation are handled together from the outset, there are more opportunities for efficiency. However, the ownership of the facilities will still be with LIP.

However, the preliminary design of the proposed WWTP and wastewater pipelines in LIP has already been completed. Thus from the view of project implementation, DBO may not be applicable for these components due to the actual project progress.

To solve the urgent need of LIP for professional O&M services, Option 3 – O&M (LIP to collect tariff from customers) is recommended for LIP for wastewater sector, which is simple to contract and easy to implement. While, Option 1- DBO can be applied for Water Supply service in LIP. Combination of DBO and O&M can effectively solve the current needs of LIP and assist LIP to achieve long term sustainable development.

1 INTRODUCTION

1.1 Project Background

1. Liuchuan Industrial Park (LIP) is located in Jingyuan County of Gansu province. LIP is located 25 kilometers (km) from Baiyin City and 100km of Lanzhou City, the Province capital. In a planned area of 23 km^2, LIP is one park of the "one zone and six parks" comprising Baiyin Industrial Concentrated Zone, which is a strategic industrial base of the Lanbai ("Lanzhou – Baiyin") Core Economic Zone.

2. LIP aims at attracting the transfer of large and medium industrial enterprises from China's eastern region, focusing on rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, electrical power generation, construction material industries, and logistics/warehousing facilities. The area possesses advantages in terms of land availability and location, coal, water, and labor resources. It comprises mostly wasteland and low hills, with little farmland and few inhabitants. There are provincial level road and railway links. Water supply will come from the Yellow River about 20km kilometers away.

3. Asian Development Bank (ADB) has proposed a loan to the People's Republic of China (PRC) for the Gansu Baiyin Urban Development II Project. The project aims to promote inclusive and environmentally sustainable urban development in Baiyin Municipality by accelerated industrial transformation and economic diversification of Baiyin. There are four major outputs:

   (i) Basic urban infrastructure in LIP comprising (a) 60,000 cubic meters per day (m^3/d) water supply system; (b) 35,000 m^3/d wastewater collection and treatment system; and (c) 6-km new road and associated utility services. See Figure 1.

   (ii) Intelligent Traffic System (ITS) in the Baiyin District;

   (iii) Technical and vocational education and training (TVET) infrastructure, equipment, and related services for Baiyin Municipality and Jingyuan County;

   (iv) Project management and institutional capacity building, including environmental management of the industrial area, and the sustainable operation and maintenance (O&M) of project facilities.

4. ADB is financing the facilities to achieve an overall development objective of a proper development and operation of the LIP with comprehensive and reliable water and wastewater facilities and with minimum environmental impact.

Figure 1 Project Location Map

1.2 Objectives of This PPP Study

5. The objectives of this study are to examine the applicability of PPP to LIP water supply and wastewater services, in particular to:

- Identify PPP options suitable for LIP
- Identify and advise appropriate commercial and financial structures
- Organize a market sounding meeting to refine/finalize the PPP design
- Assist the Tender Document preparation.
- Assist the bid assessment process
- Conduct capacity training for the Baiyin municipal government and LIP Management Committee.

6. Due to the limited timeframe of the PPTAs, market sounding, tender document preparation and bid assessment will be carried out in a separate consultancy service which will not be included in this PPTA.

1.3 Summary of the Work Carried Out

7. The following activities were carried out during the period of this study:

PPP study Inception workshop (28 May 2014)

8. A workshop was held in Baiyin on 28-May-2014 to introduce the structure of PPP and share the idea of various options can be applied for LICP water and wastewater projects. The government of Jingyuan county and LCIP identified two possible PPP schemes and requested PPP team to conduct further study: (1) Operations and Management (O&M) scheme; and (2) Design, Build and Operate (DBO) scheme.

PPP study tour (5~6 November 2014)

9. ADB organized a study tour for LIP PMO in order to provide a better understanding about PPP by learning of the operating PPP projects and sharing the experience with the operators through the 2 days site visit. During 5~6 November 2014, the delegation visited Hefei Wangxiaoyin WWTP which is operated by Berlinwasser China Holding (BCH) under a Transfer-Operate-Transfer (TOT) contract and Shanghai Chemical Industry Park WWTP which is operated by the Joint Venture Company formed by SCIP Development Company & SCIP Investment Company and SINO French Water Development Company Ltd under a 50-year concession contract (see Appendix A for the study tour report).

PPP interim workshop (25 November 2014)

10. After the site visits, the PPP team provided the interim workshop in Jingyuan (Gansu Province) on 25 November 2014 to summarize the findings from the PPP study tour and introduce the 6 options of PPP scheme of water supply and wastewater services for LIP. The pros and cons, key points for implementation in terms of technical, finance and commercial of these 6 options were also been discussed during the workshop (See Appendix B for the presentation slides). Both Jinyuang County Government and LIP Management Committee agreed to carry out a short operation period by DBO scheme on water supply plant and wastewater treatment plant in LIP, Meanwhile, the government of Jinyuan county able to identify the performance of the operator through its demonstration in LIP project in order to select a qualified future partner to work on the full concession water service in Jingyuan water supply and wastewater treatment services They expects the PPP consultant can further analyze the feasibility of this approach and assist to structuring of the project (including contract terms sheet, market sounding). Jinyuan Water Supply and Drainage Company also agreed with this approach and also be approached by numbers of private operator to discuss the opportunity of concession of water supply and wastewater services in Jinyuan County. They also agreed that O&M could also be a practical PPP approach in the short term. Therefore, O&M and DBO are short listed for further study

11. The work carried out under this PPP study is summarized in Table 1 below.

Table 1 Work Carried Out in the PPP study

Tasks	Key Content	Stage
Identify various PPP scheme	• Introduce the principles of PPP and its implementation; • Identify the need and the feasible structure of this project.	Inception
Market Sounding/ Site Visit	• Visit Hefei Wangxiaocheng Sewage Treatment Plant on 5-Nov 2014 • Visit Shanghai Chemical Industry Park on 6-Nov 2014. • Review meeting of the visit and further action plan	Market Sounding / Site Visit
Defining the appropriate PPP scheme	• Conduct technical, financial, and commercial analysis • Define an appropriate PPP scheme; • Introduce the principles of the service contract & bidding document;	Final

1.4 Definitions

12. This report uses the following definitions:

- Owner: the organization or government agency who owned the assets of facilities
- Operator: the company who was been appointed to provide the defined service by the asset owner.
- Contract: legal agreement signed between the Owner and the Operator
- Customers: the end users who receiving water supply or producing wastewater within the service area of the facilities

2 EXISTING AND PROPOSED WATER SUPPLY AND WASTEWATER FACILITIES IN JINYUAN COUNTY

2.1 Existing Water and Wastewater Facilities in Jinyuan County

13. Currently, there are one water supply plant (WSP) and one wastewater treatment plant (WWTP) in Jingyuan County. These facilities serve primarily domestic customers.

2.1.1 Water supply system in Jinyuan County

14. Jingyuan Wujiawan Water Supply Plant (JWWSP) is located at the north west of Jingyuan County City, near Wujiawan Village, less than 20km from the LIP. The plant was established in 1985 with treatment capacity of 5000 m^3/d (Phase I). The phase II project expand the plant by additional 10,000m^3/d. Due to the aging of the phase I facility, the current total treatment capacity is 12,000m^3/d. The phase III project is under construction and will be in use in 2015. The total treatment capacity will reach 32,000m3/d after the completion of the phase III project.

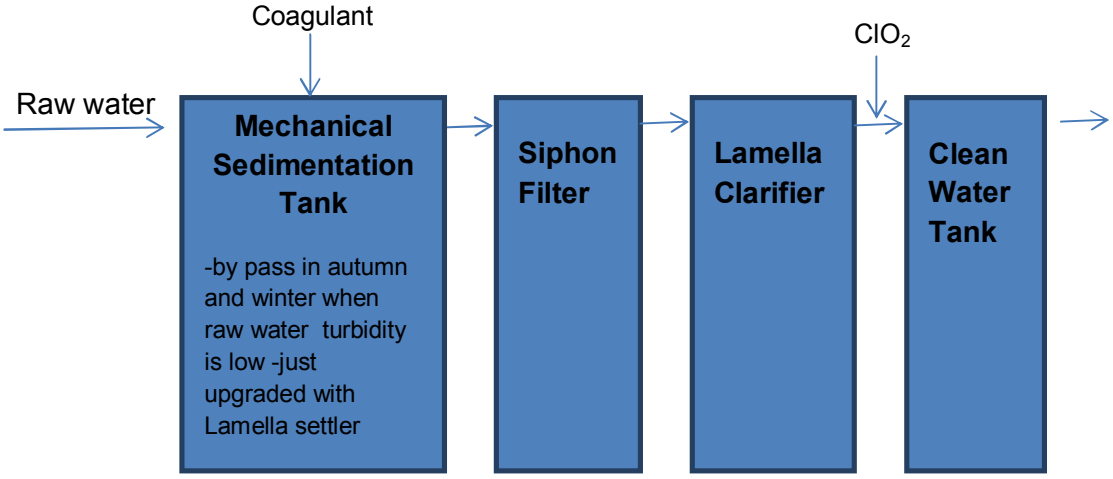
15. The service population of JWWSP is around 120,000. The average treatment volume of JWWSP is 10,000 m^3/d in autumn and winter and 18,000m^3/d in spring and summer. The seasonal fluctuation is substantial. There is also substantial fluctuation in raw water quality. As the raw water is from the Yellow River, the turbidity is high in summer.

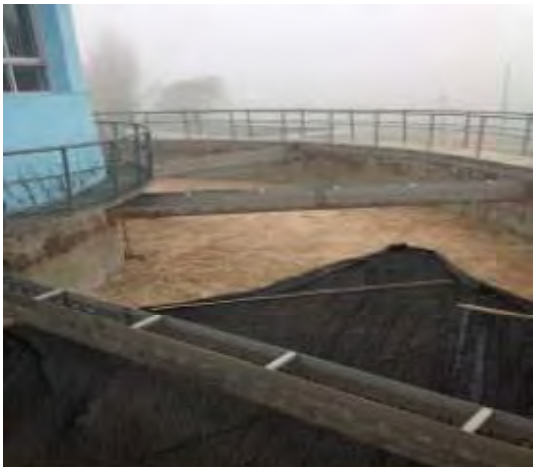
16. The plant is owned and operated by Jingyuan Water Supply & Drainage Company itself. There are 14 staffs working in the plant among which eight are operation staffs.

17. The current domestic water tariff (include wastewater tariff) of Jingyuan County is 2.9 CNY/m^3. Breakdown as below:

- Domestic Water Supply : 2 CNY/m^3
- Water Resource Fee: 0.2 CNY/m^3
- Wastewater: 0.7 CNY/m^3

18. The water treatment process of the JWWSP is as below:





Lamella Mechanical Sedimentation Tank

Siphon Filter

Clean Water Tank

Lamella Clarifier

2.1.2 Water supply system in Jinyuan County

19. JWWTP is located at the north east of Jingyuan County City, about 20 km from LIP. The plant started operation in 2012. The treatment capacity is 10,000m^3/d, but the average treatment volume is only 4,800 m^3/d. This is mainly due to the low sewerage network coverage (less than 80%). The new town area of Jingyuan County City is using separate sewer system for stormwater and wastewater, but the old town area of the county city is still using combined system. This results in low, influent Chemical Oxygen Demand (COD) of around 100 mg/L. Typically it is 350 mg/L. The network upgrading project to is ongoing.

20. JWWTP is operated by a private operator (Hebei Yongyi) under an O&M contract. It was previously operated by Jingyuan Water Supply & Drainage Company (only for less than 0.5 year). There are 16 staffs of Hebei Yongyi and one staff of Jingyuan Water Supply & Drainage Company working in the plant.

21. The treatment process is as below (shown in Process Flow Diagram):

Process Flow Diagram

Coarse Screen

Grit Removal Chamber

CASS-SBR Basins

Table 2 Basic Data about Jingyuan County Water and Wastewater Infrastructure

	Jingyuan County Wujiawan WSP	Jingyuan County Urban WWTP
Plant Location, distance to LIP (km)	18 km	20 km
Distance to intake/discharge point (km)	0.6 km	2 km
Design Capacity (m^3/day)	30,000	10,000
Production Capacity (m^3/day)	10,000	5,000
Commission date	September 2003	November 2011
Construction costs (million RMB)	13890	4230
Number of staff (operation)	14	16
Ownership of the assets	Jingyuan County Water and Wastewater Company	Jingyuan County Water and Wastewater Company
O&M entity	Jingyuan County Water and Wastewater Company	Hebei Yongyi
Service Area Coverage (km^2)	30	10

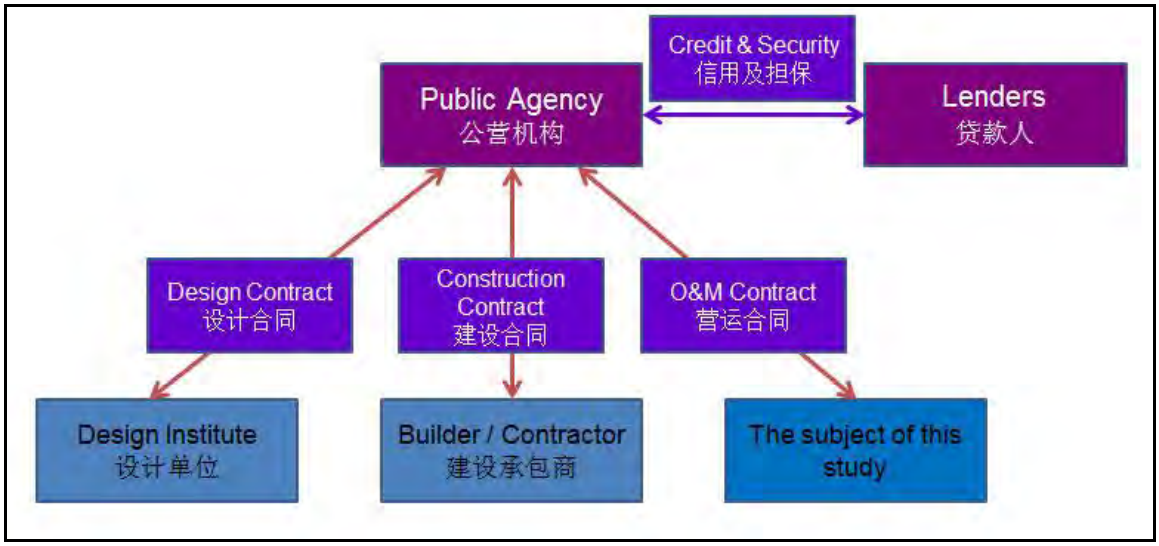
Source: Interview

2.2 LIP Proposed Water and Wastewater Infrastructure

22. By year 2020 the planned area of the LIP is 23-km^2. Ultimately the LIP will be 100 km^2 of which detailed planning for 50 km^2 is completed.

23. Figure 2 illustrates the financing and contractual relationships of the Project. ADB is one of the Lenders.

Figure 2: Project Relationships



2.2.1 LIP Water Supply System

24. Water from the Yellow River will be settled and then pumped 14.3 km through a transmission pipeline to a conventional water treatment plant from which is will be pumped to industrial customers and to a residential housing area inside the LIP. The Yellow River is a Class II - III water source[1] and the treated water will comply with PRC standards for drinking water. Table 3 lists the components:

Table 3: Liuchuan Industrial Park Water Supply Facilities and Equipment

System	Facility	Capacity	Structures and Equipment
Water Supply	Intake Station	60,000 m^3/d	Inlet gates (3); trash rack; horizontal single-stage double suction centrifugal pumps (3); electrical power connections, instrumentation
	Preliminary Water Purification Plant		circular, reinforced concrete, radial flow sedimentation tanks (4) with sludge removal system and chemical feed system
	Preliminary WSP Pump Station		Single-stage booster pump station with horizontal, single-stage, double-suction centrifugal pumps (3), electrical power connections, instrumentation

[1] The PRC's Environmental Quality Standards for Surface Water (GB 3838-2002) defines five water quality classes for different environmental functions: Class I for headwaters and natural reserve; Class II for 1st class of drinking water sources and habitats of rare aquatic organisms; Class III for 2nd class of drinking water sources, aquiculture and human contact; Class IV for water source of industrial use and recreation area for indirect human contact; Class V for water sources of agriculture use and landscaping requirement. There is also "worse than Class V."

System	Facility	Capacity	Structures and Equipment
	Water Transmission Pipeline	DN1200mm, 14.3 km	3 regulator towers, 18 exhaust wells, 14 vent wells, and 6 manholes.
	Secondary Water Purification Plant	60,000 m^3/d	pre-chlorination, coagulation with poly-aluminum chloride, horizontal sedimentation tanks, filtration by V-filter, and clean water tank with disinfection by liquid chlorine
	Treated Water Pump Station		Single-stage double suction pump (6) with electrical power connections, instrumentation
	Distribution System Piping	DN 400 – 1000, 45.23 km	Valves, blow-offs, customer water meters

DN = Nominal Diameter; LIP = Liuchuan Industrial Park; km = kilometer; m^3/d = cubic meters per day; mm = millimeter

25. The water will be treated to comply with PRC standards GB5749-2006 "Drinking Water Health Standards" and GJ3020-93 "Drinking Water Quality Standards"

26. Preliminary staffing plans are:

- the Water Supply Company will have a staffing of 40 people
- the primary water purification plant will have a staffing of 36 people, and
- the secondary water purification plant will have a staffing of 45 people.
- All positions are skilled.

2.2.2 LIP Wastewater System

27. The proposed wastewater system collects domestic and industrial wastewater, treats to PRC Class 1A standards (GB18918-2002), and 100% of the treated effluent is reused by industries and for landscape irrigation within the LIP.

28. Industries will pre-treat their wastewater to comply with PRC Standard CJ343 - 2010: Wastewater Discharges into Urban Sewerage Networks for the classification for WWTP with reuse water treatment processes.

29. Table 4 lists the facilities, structures, and equipment for the wastewater system.

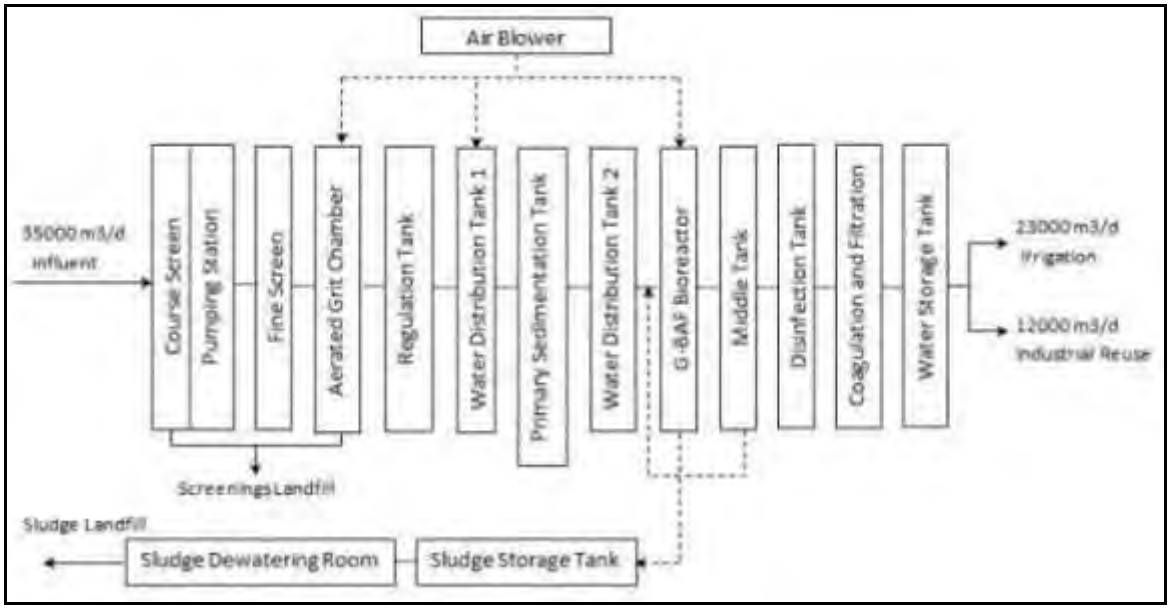
Table 4: Liuchuan Industrial Park Wastewater System Facilities and Equipment

System	Facility	Capacity	Structures and Equipment
Wastewater	Wastewater Collection System	DN400 – DN1200	46.035 km of reinforced concrete pipe with manholes and valves and flow measuring instruments
	Wastewater Treatment Plant (WWTP)	35,000 m^3/d	Pumps; motors; air blowers; sludge scraper mechanism; hoists; chemical feeders; instrumentation (volume, level, pressure), in-line analyzers
	Wastewater Bio-Solids (sludge) Treatment	'---	Plate and Frame Filter Press
Reclaimed Water	Reclaimed Water Storage Tank and Pump Station	35,000 m^3/d	Details to be determined

Source: FSR DN = Nominal Diameter, km = kilometer, m^3/d = cubic meters per day

30. Figure 3 illustrates the wastewater treatment process which uses a process called G-BAF, a type of Biological Aerated Filter. The G-BAF technology uses macro-porous mesh suspended media which combined with a mixture of microorganisms and enzymes creates an anaerobic – anoxic – aerobic integrated micro-environment, facilitating the formation of nitrogen flora microenvironment. The micro-organisms can grow under either aerobic or anaerobic conditions and can function over a temperature range of 5 to 45 ^{o}C which is useful in Baiyin where winters are cold and summers are hot.

Figure 3: LIP Wastewater Process Flow Diagram



Source: FSR Figure 5.11

Note: The FSR shows 23,000 m^3/d for irrigation but estimates are it will be less than 6000 m^3/d. That increases the volume of reclaimed wastewater available for industrial reuse.

31. Wastewater sludge will be dewatered and transferred for landfill[2].

32. The estimated staffing requirements for the wastewater treatment plant are shown in Table 5. These are all skilled positions.

Table 5: Estimated Staffing Requirements

Staff Category	Number of people	% of total
Management, engineering, service personnel	5	19%
Direct production workers	15	58%
Auxiliary production workers	6	23%
Total	26	100%

Source: FSR Table 5-28

[2] PRC Standard GB16889-2008 specifies 60% water content of sludge disposed in landfills.

33. For the wastewater collection system typical staffing would be one supervisor with two teams, each consisting of four people and each with a service truck equipped with lift crane and winch and tool boxes. Supervisor and two of the three team members would be skilled positions, while the other two team members could be unskilled.

2.2.3 Wastewater Reuse

34. The system for reusing treated wastewater in the Industrial Park has not yet been designed. LIP is committed to reusing treated wastewater and will self-fund a separate pipeline system conveying the reuse water to be used for landscape irrigation. Preliminary indications are it will be 11.5 km in length and will have valves and blow-offs.

35. Industries that will use the reclaimed water will finance and build their own pipelines to transfer the reused water to their facilities.

36. Since the WWTP is located at an elevation below the industries, there must be a Reclaimed Water Pump Station located close to the WWTP and a storage tank for about one day's volume, i.e. capacity 35,000 m3.

37. The Reclaimed Water system (storage tank, pump system, pipeline) is similar to water supply and wastewater in terms of operations and maintenance. It will be more efficient, although an added cost, to have specific workers for the Reclaimed Water system rather than use water supply or wastewater staff. For example one team of 4 people for the Reclaimed Water Pump Station and a second team of 4 people for the Reclaimed Water pipeline.

3. ANALYSIS OF EXISTING MANAGEMENT CAPABILITY, AND NEEDS FOR PPP

3.1 Institutional Arrangement for the Existing Water & Wastewater Facilities in Jinyuan County

38. As discussed in Section 2.1 above, JWWSP is owned and operated by Jingyuan County Water Supply and Drainage Company. JWWTP is owned by Jingyuan County Water Supply and Drainage Company but operated by a private operator under an O&M contract.

Table 6 Operation of the Existing Water & Wastewater Facilities in Jinyuan County

	JWWSP	JWWTP
Distance to LIP	18 km	20 km
Design Capacity	30,000 m3/d	10,000 m3/d
Production Capacity	10,000 m3/d	5,000 m3/d
Commission date	September 2003	November 2011
Construction costs	138,900,000	42,300,000
Number of staff	61	30
Ownership of the assets	Jingyuan County Water Supply and Drainage Company	Jingyuan County Water Supply and Drainage Company
O&M entity	Jingyuan County Water Supply and Drainage Company	Private operator: Hebi Yongyi
Service Area Coverage	30 km^2	10 km^2

3.2 Institutional Arrangement for the Proposed Water & Wastewater Facilities in LIP

39. The proposed water and wastewater treatment facilities of the LIP will be owned by the LIPC. Institutional arrangement and management mechanism of the proposed WTP and WWTP are to be developed.

3.3 Assessment of LIP and Local Water/Wastewater Company Management Capability

3.3.1 Assessment of LIP Management Committee

40. The LIP Management Committee current focus is (a) Investment promotion of the Industrial Park; (b) getting companies to commit to establish the production facilities in the LIP; (c) construction of the associated buildings and infrastructure to support companies already committed (e.g. aluminum company, ceramics company); (d) applying to Asian Development Bank (ADB) for a loan to construct infrastructure facilities including utility services of water supply and wastewater system.

41. At the current stage, there is no need for LIP to have staff experienced in utility services operations and maintenance. However, before the completion of water supply and wastewater facilities, LIP need to build up its utilities operation team.

42. So the assessment is that the LIP Management Committee currently has no capacity for water and wastewater operations, maintenance, and management.

3.3.2 Assessment of Jingyuan County Water Supply and Drainage Company

43. Jinyuan County Water Supply and Drainage Company owns both water supply (JWWSP and its associated network) and wastewater facilities (JWSP and drainage network) in Jinyuan County. However, it only operates the water supply facilities (JWWSP and its associated network) and drainage network. The wastewater treatment plant is operated by a private operator, Hebei Yongyi, under an O&M contract. Review of Table 2 shows that the current facilities are considerably smaller than those planned for LIP. Moreover, considering that usually industrial park (industrial users) has higher requirements for utilities services, then Jingyuan County Water and Wastewater Company may not be capable to operate the water supply and wastewater facilities proposed for the LIP in this project.

Table 7 Management Capacity of Jingyuan County Water Supply and Drainage Company

Operational Staffs of Jinyuan County Water Supply and Sewage Company	7days per week 24 hours per day
Staff Training	On Job
Safety SoP	No
Maintenance and Trouble Shooting Devices	Lack of
Computerized Information Management & Asset Management	No

3.4 Challenges for Management of Water/Wastewater Facilities in LIP

44. The Challenges LIP facing for Management of Water/Wastewater Facilities include:

Uncertainties in development

45. As currently the tenants of the LIP are not confirmed yet, it is difficult to accurately estimate the water demand and wastewater production of LIP at this stage.

Lack of Professional Support

46. As discussed above, LIP Management Committee currently has no capacity for water and wastewater operations, maintenance, and management, and Jingyuan County Water & Drainage Company has outsourced its operation of the sewage treatment plant to the private operator. Neither of these agencies have sufficient human resources and technical expertise to operate the LIP's water supply and sewage treatment facilities. The requirements and duties of a professional WTP/WWTP operator are summarized in Table 8 below.

Table 8 Requirements and Duties of a Professional WTP/WWTP Operator

Item	Water Supply Plant （WSP）	Wastewater Treatment Plant (WWTP)
Responsibility of Operation & Management	To deliver quality water with safety operation is the priority mission of managing the WSP. The operation entity have to be responsible for water supply planning, production, monitoring and routine operation reporting to the supervisory department of public sector. It shall be covered the whole process management from raw water delivery, production and water distribution have to comply with the relevant standards, regulations and practices.	The operation and management of WWTP includes planning, organizing, controlling and co-coordinating in the routine operation. The operation entity should conduct management in the whole process from the collection of influent, primary and secondary treatment and even tertiary treatment to ensure the treated effluent can meet discharge standards.
General requirements of operation and management	(1) Produce to demand The capacity of WSP should meet the demands of urban water supply. The treating water quality should meet the national standards (2) Economic production To control the Opex at the lower level as possible but it has to ensure the stability and safety of production (3) Professional production The operators shall leverage its professional knowledge & skills and utilize the advanced technology to ensure the delivery of safety and quality of water.	(1) Produce to demand The operation and management of WWTP should meet the requirements of city and water environment. The effluent quality should meet the national standards. (2) Economic production To control the Opex at the lower level as possible. (3) Professional production The operators shall have the professional knowledge and know-how to treating the wastewater can be complied with the discharge standards and pollutants control.
Controls of Water Quality	The water quality monitoring and control are the key and goal of all work. The water quality management includes the responsibility system, investigation system, technical standard, water quality control, safety production system and stable water pressure.	The water quality management is the core and goal of all work. The water quality management includes responsibility system, three-level examination system (environmental monitoring department，industrial park and sewage station).
Duties and mission of operator	(1) Be proficient in operation of WSP Operation manager shall have the related knowledge of physics, chemistry, microbiology and electromechanical equipment.	(1) Be proficient in operation of WWTP Operation manager shall have the related knowledge of physics, chemistry, microbiology and electromechanical equipment.

Item	Water Supply Plant （WSP）	Wastewater Treatment Plant (WWTP)
	(2) Observe the rules and regulations Operation manager shall observe the rules and regulations, which include post duty, facility inspections system, equipment maintenance system, shift system and safety operation system.	(2) Observe the rules and regulations Operation manager shall observe the rules and regulations, which include post duty, facility inspections system, equipment maintenance system, shift system and safety operation system.

Opex = Operating Expenses

Risk Management

47. Building and operating a public facility entails a number of risks, such as the risk of construction cost overruns, higher than expected maintenance costs, increases or decreases in demand for the services provided，unexpected criteria changes during the operation period and so on. The public sector has traditionally accommodated these risks. Under PPP risks have to be specified, quantified, and apportioned to the customer or contractor with the majority transferred to the private sector.

Sustainable Infrastructure

48. As listed in Table 7 above, currently, there is no computerized asset management system implemented in Jingyuan Water Supply and Drainage Company. To achieve sustainability of water and wastewater infrastructure in LIP and Jingyuan County, asset management system should be set up to prepare for the future funding requirement.

3.5 Needs of Water/Wastewater Facilities Management in LIP

49. The Needs of water/wastewater facilities management in LIP are:

- The water and waste water facilities to be built in LIP need an experienced operation and management team to serve the industrial customers. This includes minimum interruption of water supply, emergency response to accidents, active leakage reduction, etc.
- As there is uncertainties in the development of LIP and Jingyuan Water Supply and Drainage Company lack of experiences in dealing with those uncertainties, LIP needs an experienced operator to share the operational risks.
- The ownership of the proposed water and wastewater facilities should belong to LIP or Jinyuan government. Any change or transfer of ownership of the asset that financed by ADB must be approved by ADB.
- LIP will need leverage owned asset to finance future new investment (such as: sludge disposal facilities, water distribution pipelines, brunch sewers, upgrading or expansion of the WTP/WWTP).

50. Therefore, there is a great necessarily for LIP to outsource its water and wastewater services. Major reasons include:

- Technical reasons

- Benefit from technical and managerial knowledge
- Assurance of complying with the technical and legal requirements of public health and environmental protection in sensitive areas
- Gains the best professional skills, updates and research support.

➢ Human Resources reasons

- Gain from the professional company to motivate, retain, and attract employees (training, work flexibility, research and development, etc.)
- Effective utilization of human resources
- Avoid having to recruit, train, and manage employees

➢ Asset Management reasons

- Maintain the Integrity of the assets ownership of LIP
- Minimize the operational risk.

4 DEVELOPING A PPP SCHEME FOR LIP

4.1 Introduction of PPP and Its Principles

51. The term "public–private partnership" (PPP) describes a range of possible relationships among public and private entities in the context of infrastructure and other services.

52. PPPs present a framework that—while engaging the private sector—acknowledge and structure the role for government in ensuring that social obligations are met and successful sector reforms and public investments achieved. A strong PPP allocates the tasks, obligations, and risks among the public and private partners in an optimal way.

53. Effective PPPs recognize that the public and the private sectors each have certain advantages, relative to the other, in performing specific tasks. The government's contribution to a PPP may take the form of capital for investment, a transfer of assets, or other commitments or in-kind contributions that support the partnership. The government also provides social responsibility, environmental awareness, local knowledge, and an ability to mobilize political support. The private sector's role in the partnership is to make use of its expertise in commerce, management, operations, and innovation to run the business efficiently. The private partner may also contribute investment capital depending on the form of contract.

54. The structure of the partnership should be designed to allocate risks to the partners who are best able to manage those risks and thus minimize costs, achieve "value for money (VfM)"[3] while improving performance.

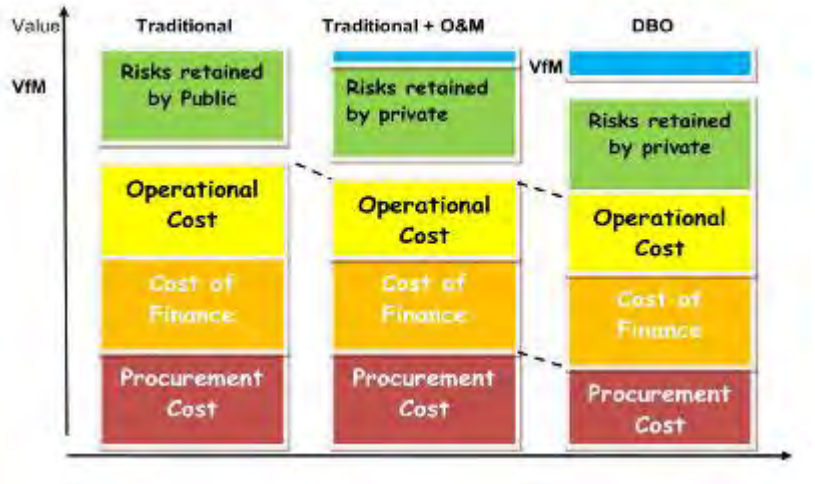


Figure 4 Comparison of Value for Money of Traditional procurement method with O&M and DBO Schemes

[3] The 'value for money' means that the estimated cost over the life of the contract (calculated at Net Present Value by assessing future costs at today's prices) should be lower than the notional cost of traditional procurement using a Public Sector Comparator.

4.2 Types of PPP for Water Supply and Wastewater Services

55. There are various types of PPP (Table 9 provides details on each of these commonly referred) but the most common practice found from the water market in China requires the private sector to Build-Operate-Transfer (BOT) or Design-Build-Finance-Operate (DBFO) facilities, usually for 25 - 35 years operation. The private sector finances construction and is repaid by the public, in regular payments. For the use of the assets and services provided under a facilities management contract，payments are classified as revenue, not capital, and thus do not count against public borrowing and does not commence until the facility is completed. It therefore has enormous short-term political appeal.

Table 9: PPP Options for Water Supply or Wastewater

Option	Definition	Operator Responsibilities	Asset Ownership	Operations and Maintenance	Capital Investment
O&M Contract	Performs management services to the utility in return for a fee	Manage the facilities either with Owner's staff or Operator's Staff	Contracting Authority	Private	Public
Lease	Runs the business, retains revenue from customer tariffs, pays a lease fee to the contracting authority, but does not finance investments in infrastructure assets	Employing staff and operating and maintaining the utility	Contracting Authority	Private	Public
Design-Build-Operate (DBO)	Designs, builds the infrastructure. Operates the business, but does not finance investment.	Designs, constructs, and operates the infrastructure with staff it employs.	Contracting Authority	Private	Public
Concession	Runs the business and finances investment, but does not own the infrastructure assets	Employing staff and operating and maintaining the utility. Financing and managing investment	Contracting Authority	Private	Private
Build-Operate-Transfer (BOT)	Builds the infrastructure. Runs the business and finances investment. Later transfers the infrastructure assets to the Public	Designs, constructs, finances, and operates the infrastructure with staff it employs.	Private Sector until transfer	Private	Private

Option	Definition	Operator Responsibilities	Asset Ownership	Operations and Maintenance	Capital Investment
Concession Full or Partial ("privatization")	Runs the business, finances investment, and owns the infrastructure assets	Employing staff and operating and maintaining the utility. Financing and managing investment	Private Sector	Private	Private

ADB, "A Practical Guide to Public-Private-Partnerships (PPPs)"

56. For LIP, the water supply and wastewater treatment facilities are funded by the Asian Development Bank, the provincial government, and local government investment, so it is not appropriate to invite investors and execute the project by DBFO/ BOT schemes. The most practical approach to utilizing PPP is to outsource the operation and maintenance services of the facilities to a private operator under a facilities management contract. This would happen when the infrastructure is completed and without change in asset ownership. This approach would also solve the problem of LIP lack of facilities management experience.

4.3 Discussion on the Short-listed PPP Schemes

57. LIP is urgent need to look for a professional operation company to take over the operation of the water / wastewater treatment plants so as to ensure the facilities would be managed under a professional performance in LIP, and also ensure the sustainable development in the LIP and extend to Jingyuan County. The participants agreed that it is also a good point to attract more investors to establish the production facility in LIP by improving the management of the public services.

58. However, as currently the tenants of the LIP are not confirmed yet, it is difficult to estimate the water demand and wastewater production of LIP at this stage, which may affect the PPP implementation.

59. Jinyuan County also hope future financing on the infrastructure development in the park by leverage the Jingyuan County's water assets

60. Based on the above concerns, 5 PPP options were developed:

Option 1 – Design – Build – Operation (DBO)

Option 2 – O&M (operator to collect tariff from customer)

Option 3 – O&M (LIP to collect tariff from customer)

Option 4 – O&M W/WWTP + BOT on new facilities

Option 5 – Lease

61. These options are discussed in the following sections.

4.3.1 Option 1 – Design – Build – Operation (DBO)

4.3.1.1 What is DBO?

62. Design- Build-Operate (DBO) is one of the most commonly used PPP scheme in water & wastewater sector. In a DBO project, a single contract is awarded to a private company or consortium for design, construction, and operation of the infrastructure project. Ownership is never in private hands; it is always with the government. The financing is entirely by the government[4]. DBO adds an operations component to the typical design-bid-build and bid-design/build contracts for infrastructure, which creates a single point of responsibility for design and construction and can speed project completion by facilitating the overlap of the design and construction phases of the project. The private company awarded the DBO has no long-term financial risk however they must design and construct operate the infrastructure within the contract amount.

4.3.1.2 Benefits of DBO

63. The benefits of DBO include:

- **Lower Costs** –When design, construction and operation are handled together from the outset, there are more opportunities for efficiency. Research shows DBO projects are delivered at or below the owner's budget almost twice as often as traditional project delivery methods. And cost savings don't end when the construction phase is complete – decisions made during the planning process continue to gather rewards during operation (**Figure 4**).

- **Faster Schedules** - Time is money, and both can be saved when many aspects of project planning, design, construction and procurement are done at the same time by the same team. All team members collaborate to help ensure an "operator-friendly" design and efficient construction process. The project timeframe can be shorter because all team members are involved from the start, with no "down time" usually associated with the transition of a project from one phase to the next in a more traditional project delivery arrangement.

- **Lower Risks** - In DBOs, control of the facility remains in the hands of the owner while responsibility for performance and compliance are with the DBO partner. Both the owner and DBO partner can manage risk and liability through performance guarantees, insurance, the development of maximum total project cost guarantees early on, and the implementation of quality assurance and control processes. And with the DBO partner serving as the single point of contact, management of the project by the owner is made easier.

64. For water and wastewater facilities, the contractor (and/or operator) is responsible for providing the design, construction and operate of the treatment facilities. Compared to the O&M Contract, the contractor also provides the process and the performance guarantees during the operations period as well as an extensive repair and renewal

[4] With the design–build–finance–operate (DBFO) approach, the responsibilities for designing, building, financing, and operating are bundled together and transferred to private sector partners. However DBFO is not considered for the Liuchuan Industrial Park.

obligations and may also be required to make capital investments in order to meet the owner's requirement.

65. For the LIP project there is uncertainty of the sales/treating volume of the water/wastewater plants as the development of LIP is dependent on a number of factors such as national economy and government policy.

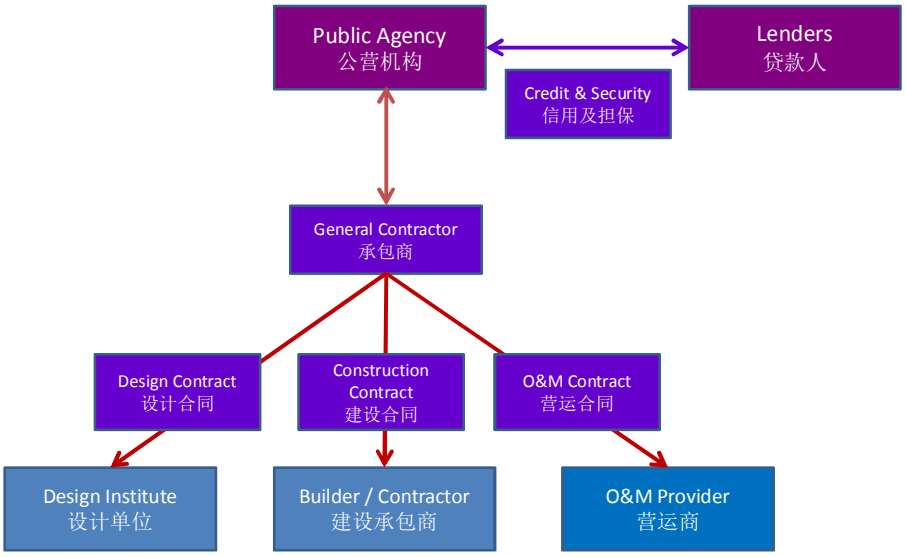
66. The primary reason for using a DBO Contract is to shift the technical risk and outsource the operating services to the private sector. However the DBO does not gain the finance support of the project initial capital.

4.3.1.3 Structure of the Relationship

67. The DBO model separates the investor (generally being the government) from the construction and operating entity, and separates the ownership from the managerial authority. This separation is attractive to bidders. Therefore, the model has a real significance to guarantee the success of infrastructure development.

68. Example. Hangu,Tianjin is an urban district characterized by chemical industries without matching waste water treatment facilities. In view of the need for urban development and environmental improvement, Tianjin Municipal Government decided to incorporate Hangu Yingcheng Waste Water Treatment Plant into the range of WB (World Bank) Loan Projects of Tianjin. In the meantime, the project also acquired the support from GEF Project (Haihe River Reach Water Environment and Water Resources Management). The GEF grant not only helps Hangu District use DBO model to develop the WWT system, but also provides certain amount of grant as an incentive to guarantee the normal operation of the plant

Figure 5 Relationships in DBO Contract



69. Payments by the Owner to the Contractor under the DBO could be structured as follows:

- a regular lump sum payment as a service fee to the Contractor; and
- a reasonable return (i.e. profit) on the fee made by the Contractor.

70. At the end of the term of the DBO contract the Owner would have these options:

(1) renewal of the O&M contract (the DBO contract might include an option to renew);

(2) accept the termination of the DBO contract and take back the facilities (and any improvements) in accordance with the terms of the DBO contract, and resume operating the facilities;

(3) commence the process of pre-qualifying potential bidders (the Operator operating the existing DBO contract could also be invited to pre-qualify) and inviting short-listed potential bidders to bid for a new O&M contract); or

4.3.1.4 Scope of Services for the Private Operator

71. Figure 5 below structures the recommended contractual relationships and service scope of the contractor if a DBO scheme is applied in this project.

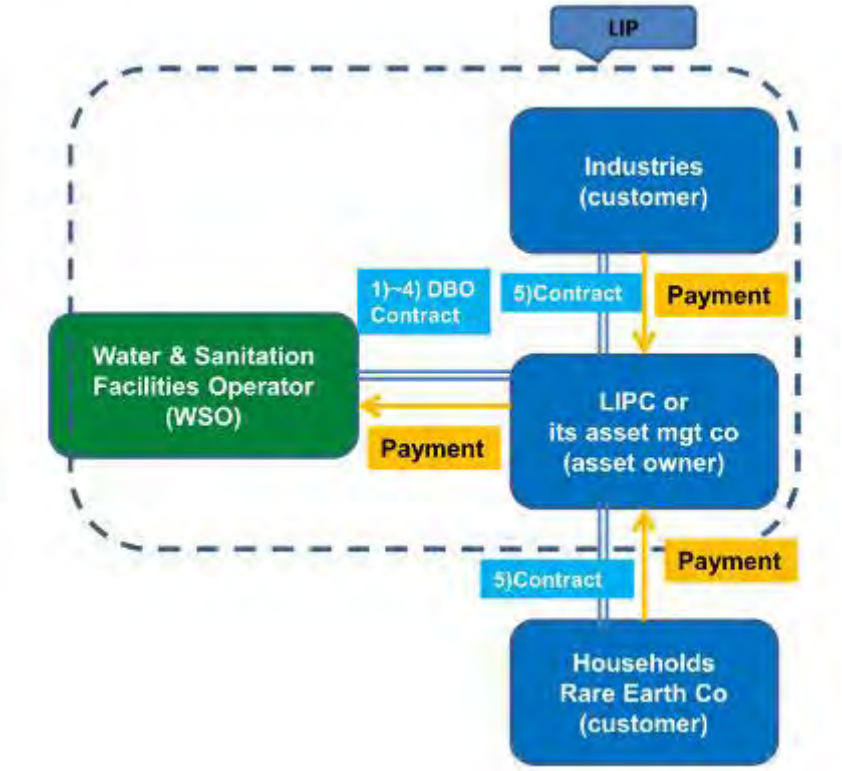


Figure 6 Option 1 – Design – Build – Operation

72. The Operator is responsible for complete Design, Construction, Operations and Maintenance of the system. Specifically, the Contractor/Operator shall carry out all provision services of the specific scope of works, provide all Equipment, Materials and

Supplies and employ all Operations Staff necessary to manage, operate, maintain, and repair the water and wastewater treatment plants of the Industrial Park.

73. The Contractor/Operator pays all costs and expenses with respect to the Operator's Management Personnel, Operations Staff and all costs and expenses related to the performance of the Services

74. This includes minor repairs. Major repairs and equipment replacement are specified in the DBO agreement.

75. The Operator bases their bid price on the existing tariffs and stipulated increases in the tariff.

4.3.1.5 Technical Issues

76. Some of the technical issues are same as for O&M Contract, for example Facilities Included In the O&M Contract; and Changes in Influent Water Quality. Issues of Spare Parts, Tools, Laboratory Equipment, and Budget for Consumables are not relevant because the Operator assumes responsibility for O&M costs (but not major repairs or equipment replacement).

77. Confirming System Data. For an existing system bidders develop their tender on data provided, for example number of customers, consumption per customer; volume of water to be treated, etc. There is a risk of inaccuracies in the data provided at the beginning of the contract. Potential bidders will adjust their bid price, usually upward, to deal with this risk. Therefore the Owner may want to consider having the data audited. Another possible solution is to include an initial verification period in the DBO agreement during which the Operator can check the data (which could then be reviewed by the Owner). Then performance standards and compensation schedules can be adjusted to take into account discrepancies discovered.

78. Periodic Confirmation of Equipment Condition and Equipment Replacement Provisions. The Owner needs confirmation about the condition of mechanical and electrical equipment, instrumentation, and civil works structures. So similar to the O&M Contract the Owner should consider hiring a 3rd party to inspect the facilities.

Towards the end of the DBO contract there should be some provisions for replacing worn equipment and making repairs so that facilities are handed back to the Owner in a fully operational condition

79. Technical O&M Programs and Documents. The Operator should maintain a computerized asset register and update the O&M manuals and records.

4.3.1.6 Financial Issues

80. The Owner will be responsible for the capital investments of the plant and facilities; for the operating service fee (usually paid on the basis of the agreed volume); and for fee specified in the DBO agreement. On the other hand, the new expansion /upgrading facilities of the plant can be invested by the DBO contractor or the Owner during the contract period. The decision would be made subject to the cost of financing, i.e. who can provide the least expensive capital.

81. Tariffs and Collection. The Owner is involved in tariff setting and bears the risk of collection. The service fee is cost-based with profit margin agreed on the DBO contract in order to cover all contractual obligations.

4.3.1.7 Risk Allocation

Table 10 Risk Allocation for DBO Contract

Liability And Risk Distribution	Owner	Operator
Defect Liability Existing Equipment		X
Defect Liability New Equipment		X
Care of the Assets		X
Insurance		X
Force Majeure	X	
Electrical Power		X
Terrorist or War Risks	X	
Change in Laws and Regulations	X	
Intellectual Property Indemnity		X

82. Force Majeure means circumstances arising and completely outside of the control and beyond the contemplation of the Parties to this Contract which renders its performance impossible and frees the Parties from their respective obligations under the Contract. Examples of Force Majeure are war, insurrection, public disorder or riot; explosion, fire, earthquake, excessive and extraordinary floods; pollution of source water where such pollution has not been caused by an act or omission of the Operator; etc.

4.3.1.8 Summary of Option 1

83. Under a DBO arrangement a private Operator DBOs the water and wastewater assets of the Owner and takes on the responsibility for operating and maintaining them. The Contractor (Operator) effectively buys the rights to the revenues from the utility's operations so the Operator assumes much of the technical risk of the operations. Under a well-structured contract the Operator's profitability will depend on how much it can reduce costs while still meeting the quality standards in the DBO contract), so it has incentives to improve operating efficiency.

84. DBOs are most appropriate for the new facilities, such as water and wastewater facilities in this project where there is the possibility of risks in technical and operational aspects.

85. In the project, short operation period 2-3 years is recommended to serve as a warrantee period for the facilities construction.

4.3.2 Option 2 – O&M (operator to collect tariff from customer)

4.3.2.1 What is O&M

86. An O&M contract expands the services to be contracted out to include some or all of the management and operation of the public service. Although ultimate obligation for service provision remains in the public sector, daily management control is assigned to the private partner or contractor. In most cases, the private partner provides working capital but no financing for investment.

4.3.2.2 Benefits of O&M

87. The key advantage of this option is that many operational gains that result from private sector management can be made without transferring the assets to the private sector. The contracts are less difficult to develop than others are and can be less controversial. The contracts are also relatively low cost as fewer staff are dispatched to the utility from the private operator. O&M contracts can also be seen as interim arrangements, allowing for modest improvements while more comprehensive contracts and structures are developed. Similarly, an O&M contract can be structured to phase-in increasingly extensive involvement of the private sector over time and as progress is demonstrated.

4.3.2.3 Structure of the Relationship

88. With an Operation and Maintenance (O&M) Contract, the Operator uses his own staff to operate the Owner's existing assets to achieve specified service levels. The Operator must maintain the facilities and equipment in good working condition and make repairs where necessary (i.e. safeguard the assets). In return the Owner pays the Operator a fee.

89. The Owner retains ownership of the facilities. The Operator has no obligation to invest any money. Rehabilitation, expansion, and new construction are NOT part of an O&M Contract

90. Contract length varies but is typically 5 to 10 years with periodic performance reviews.

91. Contractual relationship of various parties in Option 2 is illustrated in Figure 7 below.

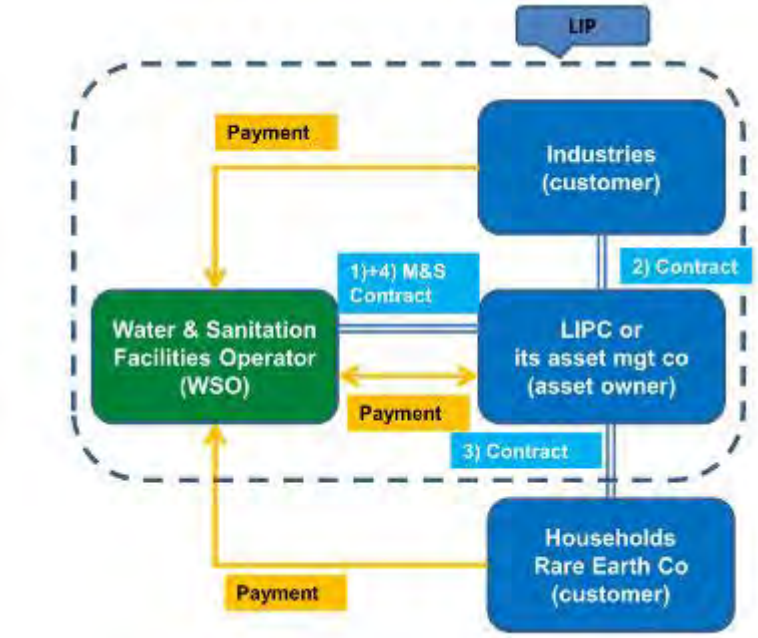


Figure 7 Option 2 – O&M (operator collected tariff from customer)

4.3.2.4 Scope of Services for the Private Operator

92. Obligations are specified as both inputs and outputs with detailed performance objectives. Penalties are associated with the failure to achieve obligations.

93. The Operator provides qualified staff to operate the systems in a cost-effective, safe, and business-like manner and in accordance with national and local laws and regulations and Good Industry Practice.

94. Specifically in China that means providing water to meet the requirements of the latest version of PRC GB5749 Sanitary Standard for Drinking Water and to treat wastewater to PRC GB 18918-2002: Maximum Allowable Concentrations of General Control Parameters.

95. Service standards of volume, pressure, quality, coverage, and continuity are also specified in the contract and there are penalties for failing to achieve if it is shown to be the Operator's fault. The contract can also specify operational requirements such as establishing a computerized asset register, a worker safety program, periodic written reports, etc.

96. The Contract also describes the extent of contact by the Operator with Customers, for example issuing bills (invoices) to Customers; collecting payment; responding to complaints; shutting off service; etc. In Option 2, LIP Management Committee delegates the operator to collect the tariff from the customer and deposit into LIP's bank account.

97. The Contract also specifies ownership of the treated wastewater and the bio-solids (sludge) produced by the wastewater treatment plant. This is important because these waste products have monetary value.

4.3.2.5 Technical Issues

98. Facilities Included In the O&M Contract. The O&M Contract can be for the entire system or for individual components of the system. For the Industrial Park it is better to have a contract only for the treatment plant and not include the water distribution or wastewater collection system.

99. Changes in Influent Water Quality. The water treatment facilities are designed to treat water of a specific quality, i.e. PRC GB 3838 Surface Water Quality Standards for Lakes and Reservoirs for Class III for 2nd class of drinking water sources. If the water source has a lower quality and does not meet the influent parameters in the PRC standard, then the Operator may have to change operations or provide additional treatment. Therefore the Operator should be entitled to compensation for any extra costs incurred in carrying out special treatment required to enable it to supply water in accordance with the Contract. The basis for development of additional costs should be specified in the contract.

100. Changes in Wastewater Influent. It is common to have some variations in volume and composition of wastewater. However the Wastewater Treatment Plant is designed based on the assumptions that (a) domestic discharges will be in accordance with PRC "Outdoor Drainage Design Regulations" (GB50014-2006, 2011); and (b) industrial discharges will be in compliance with PRC CJ343 - 2010: "Wastewater Discharges into Urban Sewerage Networks". Similar to water supply, the Operator shall be entitled to compensation for any extra costs incurred in carrying out special treatment due to changes in influent wastewater quality that it must do to produce wastewater in accordance with PRC standards.

101. Spare Parts, Tools, Laboratory Equipment. These are required for O&M and should be provided by the Owner because (a) the Owner will have these items from the initial construction; and (b) if the Operator provides it will cost more. During the duration of the Contract these items will be used and need replacing. With prior approval the Operator can procure additional spare parts, tools, and laboratory equipment and be compensated for it.

102. Budget for Consumables. Consumables include electrical power, chemicals, repair parts, petroleum-oils-lubricants. The Operator should prepare an Annual Operating Budget and submit to the Owner for approval and funding. It should include: (i) anticipated operations and repairs; (ii) maintenance and overhaul schedules; (iii) planned procurement (including equipment, spare parts, and consumable inventories); (iv) labor activities (including staffing, labor rates, and holidays); (v) administrative activities; and (vi) other work proposed to be undertaken by Operator, together with an itemized estimate of all Reimbursable Costs to be incurred.

103. Confirming Equipment Condition. The Owner will know the facilities are being properly operated from the reports on volume produced or treated and from compliance monitoring reports by the relevant local authorities, i.e. Health Bureau for Drinking Water and Environmental Protection Bureau for wastewater. The Industrial Customers will quickly report any "product problems", i.e. water quality not meeting expected standards. However it is difficult for the Owner to know if the equipment

(mechanical, electrical, instrumentation) and civil works structures are being properly maintained. Thus it is reasonable for the Owner to hire a 3rd party (i.e. another consultant or contractor) to inspect the facilities and report their condition. The first inspection could be done after 12 months while subsequent inspections could be scheduled at intervals of 12 to 24 months.

4.3.2.6 Financial Issues

104. Revenue Source. The Operator earns revenue primarily from the agreed fee paid by the Owner. There could also be a bonus or incentive payment for achieving pre-agreed targets.

105. O&M Contract Components. O&M contracting opportunities include O&M of the physical assets to be constructed and installed in the development zone, and management and administrative functions as billing and collection. O&M contract coverage can cover only the physical O&M or include the management functions.

106. Exclusivity of O&M of Facilities. The Owner is expected to clearly provide for the exclusive assignment of O&M of all water and sewerage facilities in the agreed service zone to the Operator. The Owner will agree the detailed inventory of all plant, facilities, equipment, vehicles, etc., including clear description of each item, location, acquisition date and valuation with the Operator. The Owner can only raise contractual issues over any O&M item listed and agreed with the Operator.

107. O&M Cost Items. The costs pertaining to O&M of the physical assets include personnel, power, chemicals, general maintenance and repair and overheads. Accounting for the costs of water and sewerage services would be separate, and eventually pricing the services are separate. Further division into cost centers, i.e., production, commercial, finance and administration, etc., enhances management monitoring capability (e.g., cost-efficiencies) leading to better decision-making. Separating the costs reveals performance, enables comparisons, and drive efficiencies.

108. Awarding the O&M Contract. The contract is awarded to the bidder offering the lowest O&M fee. In terms of O&M of physical assets, the fee is calculated on the basis of unit O&M or recurrent costs. The applicable unit would be the volume of water supplied or the volume of wastewater treated. Calculating the production cost against the volume will give the unit production cost. In similar manner, unit power cost is equal to total cost of power consumed divided by the volume produced over a period. Unit payroll cost can be the average salary of all personnel, or estimated according to units of production or treatment. The O&M fee is the summation of the unit costs.

109. In determining the O&M fee, the Operator requires basic information on supply source capacity *vis–à–vis* consumer demand, technical specification of each facility and equipment, cost and availability of utilities in the zone, etc. Unit cost of O&M for pumps and electro-mechanical equipment would be estimated using manufacturer's data or O&M Manual specifications and applying the latest assessed power and fuel prices. Energy cost and staff payroll are typically the largest service utility expenditures. It is to the Owner's advantage to provide all relevant information to the bidder to arrive at the best offer, including:

a. System facilities specifications available through operating manuals, as-built drawings;

b. Service area information, including population, customer profile;

c. Utilities including power, fuel, communication, other consumables;

d. Capital expenditures budget over the contract term;

e. Warranty for service, insurance of facilities to be operated, licenses to operate;

f. Water Abstraction Fees; Licensing Requirements

g. Access to facilities.

110. Bill Collection Services. In Option 2, the Owner offers contracts for operation and maintenance of the billing and collection system. The tasks include: reading customer meters; preparing water bills; delivering water bills; collecting payment; and shut-off for non-payment. The water bill includes a fee for wastewater based on estimated volume of water discharged to the sewer.

111. Base Tariff. Tariffs shall provide the revenue for Owner to finance its activities, including the O&M obligations. The revenue requirement shall cover direct O&M costs (as contracted with the Operator), capital maintenance including infrastructure renewals, and return or margin on capital employed.

112. The basic principle of tariff design is to charge service users according to the costs they impose upon the system. The initial tariff for LIP facilities is established through the Feasibility Study Reports and will be updated during detailed engineering design. The Operator does well to review the cost bases in relation to the appropriateness of the projected tariffs. The contract will provide for inputs from the Operator to Owner/Management, as well as to executive regulator, in support of succeeding tariff initiatives.

113. Other Cost Considerations.

a. O&M Staff. The Owner and Operator can agree to adopt existing personnel (e.g. Owner's staff) when assessed to be more cost-effective. The cost of training is factored in.

b. Insurance. The cost of insurance is usually the concern of the Owner of the plant and facility. However, there may be provisions in the insurance policy regarding assessment of premiums in the case of third parties. The Operator, being third party to a plant insurance, would abide by all policy requirements. Or, in the case where Operator takes a policy on 'new technology' equipment agreed for use in the execution of contracted obligation with Owner, the parties can agree on cost of premium.

c. Service Warranty. A service warranty in the O&M contract can be agreed by Owner and Operator. This provides protection to the Owner in terms of quality of service

delivery by the Operator. On the other hand, this assures the Operator of conformance by the Owner of all payment terms agreed.

d. Capital Expenditures. The Owner will provide assurance to Operator on certain capital expenditures, e.g., acquisition of service connections and appurtenances needed in an expanding distribution network, that fall under Owner obligations over the contract term.

e. Operating Budget. Operator prepares a budget for the contract term, and on a periodic basis submits for approval by the Owner.

114. Periodic Adjustments to the Operator Fee. The Owner develops a fee structure that aligns the interests of the Operator with Owner expectations. The adjustments serve to incentivize the Operator to perform well or better. The Operator has several options. One option would be to provide the Operator a proportion of an amount by which net operating revenue exceeds the anticipated net operating revenue, the latter being the base case, as in the contract. An alternative would be an adjustment formula which adjusts the fee with reference to improved plant efficiency, billing and collection, or cost savings.

115. Fee adjustment is based on periodic performance review, which could be annual or bi-annual. However, in drafting the initial O&M contract, the Owner will not have sufficient data on which to establish a base case reference. The LIP system being 'new territory' the performance standards drafted would likely be either too high or too low. To avoid this, the Owner can refer to operations standards of other similarly-scoped WSPs in the neighboring districts. The Owner can also develop a procedure for setting anticipated performance standards for the period initially referring to prevailing industry norms and later adjusting based on actual operations.

116. Payment Details. Frequency of payment; supporting documents for invoice; records retention. For example monthly payment of fee; monthly payment of consumables budget based on receipts or invoices, etc.

Table 11 Types of Payments and Basis for Calculating

No.	PAYMENT TO PROVIDER	INCLUDES	BASIS FOR CALCULATING
1	Worker Payments (payroll)	salaries, allowances, benefits, social and pension payments	Payroll documents
2	Water Production and Distribution Operating Expenses	chemicals; electricity; repair parts; petroleum, oils and lubricants; laboratory analysis	Operating Records and Audit
3	Fixed Fee	meeting minimum standards for quantity, quality, pressure, and continuity	Operating Records, Observations, Audit
4	Performance-Based Fee	performance indicators with a range of values	Operating Records and Audit
5	Penalties	failure to meet minimum standards; backsliding on performance based targets	Operating Records, Observations, Audit

No.	PAYMENT TO PROVIDER	INCLUDES	BASIS FOR CALCULATING
6	Work out of Scope		Negotiated before beginning

4.3.2.7 Risk Allocation

117. The basic principles of risk management are (a) risk should be shared between parties (the private and public sector), and (b) whoever can best control or manage the risk should assume it and receive adequate compensation for doing so.

118. Types of risk associated with Water Utility Management Contracts are shown in Table 12. Management Contracts do not usually involve design and construction so these are not included. There are no currency conversion risks with the Chinese Yuan so this type of risk is omitted.

Table 12 Risks for O&M Contract

Type of Risk	Specific Risk	Typical Causes	Actions in Advance to Minimize Risk	Who bears remaining risk
Operating	Cost Overrun	Change in operational practices	Define acceptable reasons for changes	Operator
		Increases in electricity or chemical costs	Provide mechanisms for cost adjustments	Operator
	Failure or Delay in obtaining permissions, consents, approvals	Slow processing by government agencies	Know the process; apply early; monitor constantly; active participation by the water utility	Owner
	Deficiencies in Water Quality; Shortages in Quantity; changes in wastewater influent quality	Changes in the water source	Monitor source water quantity and quality; implement source water protection practices	Owner
		Malfunction in the Treatment Process	Assess condition at contract start; implement good operations and maintenance practices	Operator
		Problems in the Distribution System		Operator
Insurance	Uninsured Loss	Insufficient insurance coverage or no insurance available	Insure adequately against main risks	Operator
Commercial or Market	Low Water Demand	No customers; high tariff rates; unusual weather	Contracts between Industrial Park Management and the Industrial Customers	Owner
	Customer Non-Payment	No money; high tariff rates	Tariff setting process with customer input; provision to discontinue service	Owner
		Unsatisfactory service	Monitor customer complaints and survey customer	Operator

Type of Risk	Specific Risk	Typical Causes	Actions in Advance to Minimize Risk	Who bears remaining risk
			satisfaction	
Financial	Exchange Rate	Fluctuations or devaluation of local currency	Make all costs and payments in local currency	Operator
	Interest Rate	Fluctuations in interest rates	Arrange financing for the entire contract duration	Operator
Force Majeure	Natural Disaster	Flood, earthquake, fire, extreme freeze	(1) special engineering design and construction for facilities and equipment that are at risk; (2) insurance	Owner
	Domestic Events	Riot, labor strike		Owner
	Political	Expropriation; revocation of visas and work permits; import restrictions	Political stability; laws and regulations that are published and enforced	Owner
	Legal & Regulatory	Changes in Law or Regulations	Well defined procedures for changing existing or introducing new laws and regulations	Owner
Environmental	Damage by current operations	Operator error or equipment failure	evaluate critical equipment; train operators; develop emergency response procedures	Operator

4.3.2.8 Summary of Option 2

119. The Operator uses his own staff to operate the Owner's existing assets to achieve specified service levels and to maintain the facilities and equipment in good working condition. The Owner pays the Operator a fee for this work.

120. The Owner retains ownership of the facilities. The Operator make repairs where necessary (i.e. safeguard the assets) but has no obligation to invest any money.

121. The Operator is responsible for all human resource issues—hiring, firing, paying, etc.

122. The Owner delegates the Operator to collect the tariff from the customer and deposit into the Owner's bank account.

123. The technical and commercial risks for both Operator and Owner are minimal.

124. Contract length varies but is typically 5 to 10 years with periodic performance reviews.

4.3.3 Option 3 – O&M (LIP to collect tariff from customer)

4.3.3.1 Differences from Option 2

125. Option 3 is similar as Option 2, the only differences is that in Option 3, the Operator is not involved in the bill collection. LIP Management Committee will be responsible for reading customer meters; preparing water bills; delivering water bills; collecting payment.

126. Contractual relationship of various parties in Option 2 is illustrated in Figure 8 below.

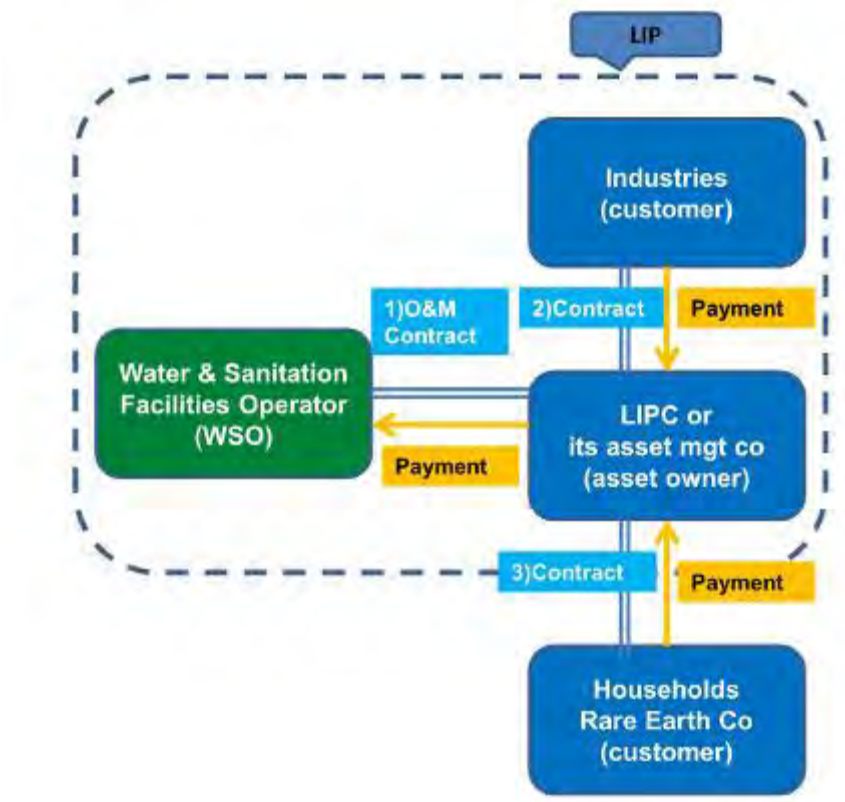


Figure 8 Option 3 – O&M (LIP pay service fee to operator)

4.3.3.2 Summary of Option 3

127. Option 3 is similar as Option 2, but the structure is more simply and easier for LIP to supervise.

128. As in the initial stage, the confirmed industrial customers in LIP are not many, LIP Management Committee will be able to issue and collect the bills itself.

4.3.4 Option 4 – O&M W/WWTP + BOT on new facilities

4.3.4.1 Differences from Option 3

129. In Option 4 is a combination of a O&M for the proposed facilities in this project and Build-Operate-Transfer (BOT) for future new facilities, with assuming capacity of the

proposed water supply and wastewater facilities in this project is not enough to meet the need of new move-in industrial customers or customers nearby LIP and new treatment systems are needed.

130. Therefore, this section will mainly discuss the BOT contract. However, the BOT contract will not involve the ADB financed infrastructures in this Project.

4.3.4.2 Structure of the Relationship

131. The structure and relation of the O&M part of the contract is the same as Option 3.

132. In BOT contract, a private firm or consortium finances and develops a new infrastructure project or a major component according to performance standards set by the government. Figure 9 illustrates the BOT contract structure.

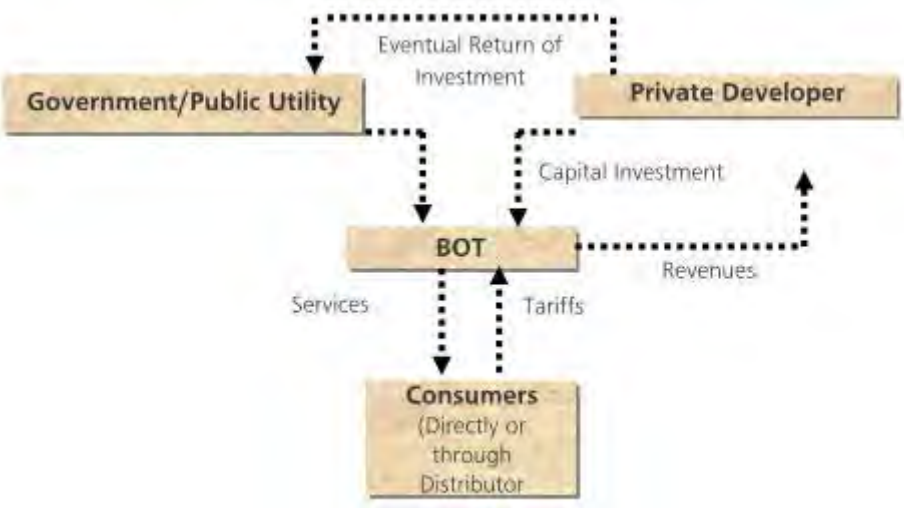


Figure 9 Option 4 – O&M W/WWTP + BOT on new facilities

4.3.4.3 Scope of Services for the Private Sector

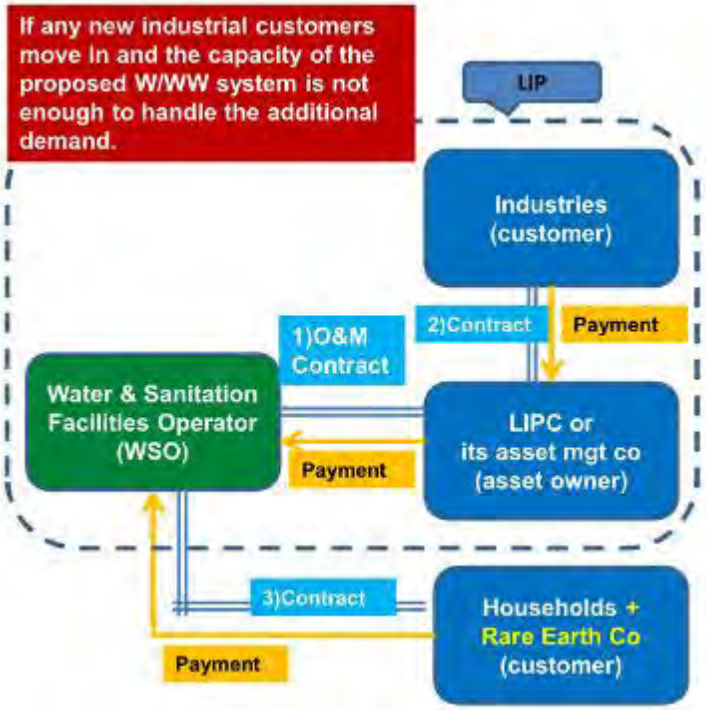


Figure 10 Option 4 – O&M W/WWTP + BOT on new facilities

133. The scope of work for the O&M is the same as Options 2 or 3.

134. Under BOT, the private partner provides the capital required to build the new facility to serve the new industrial customers or customer nearby but outside LIP. The private operator will own the new assets for a period set by contract—sufficient to allow the developer time to recover investment costs through user charges.

135. In BOT contracts, the public sector agrees to purchase a minimum level of output produced by the facility, sufficient to allow the operator to recover its costs during operation. A difficulty emerges if the public sector has overestimated demand and finds itself purchasing output under such an agreement ("take–or–pay") when the demand does not exist. Alternatively, the distribution utility might pay a capacity charge and a consumption charge, thus sharing the demand risk between the public and private partners. BOTs generally require complicated financing packages to achieve the large financing amounts and long repayment periods required.

136. At the end of the contract, the public sector assumes ownership but can opt to assume operating responsibility, contract the operation responsibility to the developer, or award a new contract to a new partner.

4.3.4.4 Technical Issues

137. BOT projects usually encourage the use of advanced technologies and there is an incentive to be efficient.

4.3.4.5 Financial Issues

138. Operator finances, owns and constructs the facility or system and operates it commercially for the project period, after which the facility is transferred to the authority.

139. BOT is the typical structure for project finance. As it relates to new build, there is no revenue stream from the outset. Lenders are therefore anxious to ensure that project assets are ring-fenced within the operating project company and that all risks associated with the project are assumed and passed on to the appropriate actor. The operator is also prohibited from carrying out other activities. The operator is therefore usually a special purpose vehicle.

140. The revenues are often obtained from a single "off-take purchaser" such as a utility or government, who purchases project output from the project company (this is different from a pure concession where output is sold directly to consumers and end users). In the power sector, this will take the form of a Power Purchase Agreement. There is likely to be a minimum payment that is required to be paid by the off-take purchaser, provided that the operator can demonstrate that the facility can deliver the service (availability payment) as well as a volumetric payment for quantities delivered above that level.

141. Project company obtains financing for the project, and procures the design and construction of the works and operates the facility during the concession period.

142. The revenues generated from the operation phase are intended to cover operating costs, maintenance, repayment of debt principal (which represents a significant portion of development and construction costs), financing costs (including interest and fees), and a return for the shareholders of the special purpose company.

4.3.4.6 Risk Allocation

Table 13 Risk Allocation for BOT Contract

Liability And Risk Distribution	Owner	Contractor
Defect Liability Existing Equipment		X
Defect Liability New Equipment		X
Care of the Assets		X
Insurance		X
Force Majeure	X	
Electrical Power		X
Terrorist or War Risks		X
Change in Laws and Regulations		X
Intellectual Property Indemnity		X

143. In BOT contract, the BOT contractor is assuming a lot of risk. It is anxious to ensure that those risks that stay with the grantor are protected. It is common for a BOT contractor to require some form of guarantee from the government and/ or, particulary in the case of power projects, commitments from the government which are incorporated into an Implementation Agreements.

4.3.4.7 Summary of Option 4

144. Option 4 is a derivative from Option 3 which only provide a reference to the LIP for long-term (2030) consideration. It is not applicable in the current stage.

4.3.5 Option 5 – Lease

4.3.5.1 What is Lease

145. A lease is a contractual agreement between the lessor and the lessee for a specified asset. The lessee receives the right to total ownership for a specified period of time in return for payments to the lessor. The Owner (Lessor) retains ownership of the assets. Affermage (also referred to as the French Model) is a type of PPP lease.

146. For water and wastewater facilities the Operator (Lessee) is responsible for providing full water and wastewater services to Customers and operates the facilities as if it were his own. The Operator has more extensive repair and renewal obligations compared to the O&M Contract, and may also be required to make capital investments.

147. For water and wastewater PPP Facility Leases, the Operator collects revenue from Customers, pays operating costs, and pays a Lease fee to the Owner. Any money remaining is profit for the Operator. Thus the Operator has greater risk compared to the O&M Contract but also the opportunity for greater reward.

148. The time period depends on the type of lease. For existing facilities it is on the order of 5 to 10 years.

149. The primary reason for using a Lease Contract is that private equity and commercial debt are not available to finance infrastructure for water supply and sanitation services.

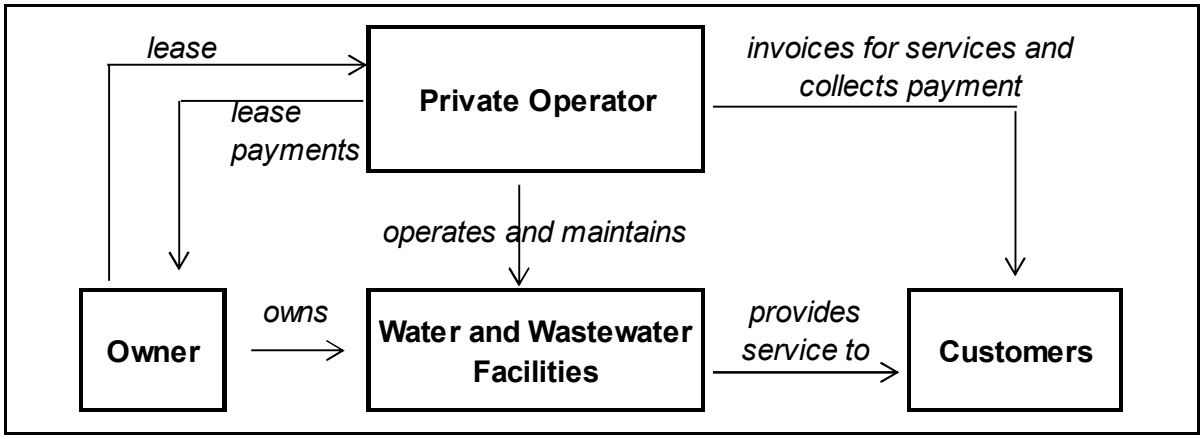
4.3.5.2 Benefits of Lease

150. Under lease contracts, the private partner's profits depend on the utility's sales and costs. The key advantage of this option is that it provides incentives for the operator to achieve higher levels of efficiency and higher sales. The principal drawback is the risk of management reducing the level of maintenance on long-lived assets, particularly in the later years of the contract, in order to increase profits. Further, the private partner provides a fee to cover the cost of using the assets although the private partner does not provide investment capital.

4.3.5.3 Structure of the Relationship

151. For existing facilities the Owner retains ownership and receives a fee from the Operator who operates and maintains the system, provides services to Customers, collects payments from Customers, and takes the risk of the cost of operations. Figure 10 shows the relationship among the Owner, Private Operator, and the Customers.

Figure 11 Relationships in Lease Contract



152. Payments by the Private Operator to the Owner under the lease could be structured as follows:

- a fixed capital payment as partial compensation for the cost of the fixed assets leased to the Operator; and
- regular payments as rent for the facilities; and
- a reasonable return (i.e. profit) on the capital investment made by the Owner

153. Lease payments to the Owner could be structured with payments in advance or after use, e.g. after the Private Operator develops a cash flow from providing services to Customers.

154. At the end of the term of the lease contract the Owner would have these options:

(1) renewal of the lease contract (the lease contract might include an option to renew);
(2) accept the termination of the lease contract and take back the facilities (and any improvements) in accordance with the terms of the lease contract, and resume operating the facilities;
(3) commence the process of pre-qualifying potential bidders (the Operator operating the existing lease contract could also be invited to pre-qualify) and inviting short-listed potential bidders to bid for a new lease contract); or

4.3.5.4 Scope of Services for the Private Operator

155. Figure 11 below structures the recommended contractual relationships and service scope of the contractor if a lease contract is applied.

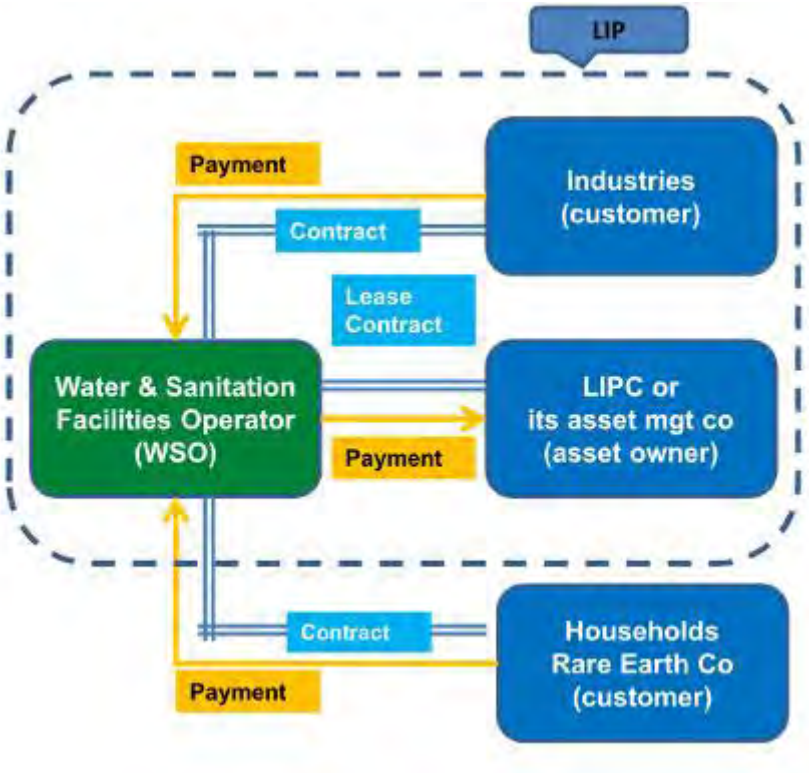


Figure 12 Option 5 – Lease

156. The Operator is responsible for complete operations and maintenance of the system to provide services to Customers in the service area. Specifically, the Operator shall carry out all Services, provide all Equipment, Materials and Supplies and employ all Operations Staff necessary to manage, operate, maintain, and repair the water and wastewater systems of the Industrial Park.

157. The Operator pays all costs and expenses with respect to the Operator's Management Personnel, Operations Staff and all costs and expenses related to the performance of the Services

158. This includes minor repairs. Major repairs and equipment replacement are specified in the lease agreement. Typically the Owner establishes a Replacement and Rehabilitation Fund to which the Operator might be expected to contribute.

159. The Operator bases their bid price on the existing tariffs and stipulated increases in the tariff. It is the Owner that sets the tariff, so the Owner cannot lower tariffs or forego promised increases. Doing so could be a breach of the lease agreement.

4.3.5.5 Technical Issues

160. Some of the technical issues are same as for O&M Contract, for example Facilities Included in the O&M Contract; and Changes in Influent Water Quality. Issues of Spare Parts, Tools, Laboratory Equipment, and Budget for Consumables are not relevant because the Operator assumes responsibility for O&M costs (but not major repairs or equipment replacement).

161. Confirming System Data. For an existing system bidders develop their tender on data provided, for example number of customers, consumption per customer; volume of water to be treated, etc. There is a risk of inaccuracies in the data provided at the beginning of the contract. Potential bidders will adjust their bid price, usually upward, to deal with this risk. Therefore the Owner may want to consider having the data audited. Another possible solution is to include an initial verification period in the lease agreement during which the Operator can check the data (which could then be reviewed by the Owner). Then performance standards and compensation schedules can be adjusted to take into account discrepancies discovered.

162. Periodic Confirmation of Equipment Condition and Equipment Replacement Provisions. The Owner needs confirmation about the condition of mechanical and electrical equipment, instrumentation, and civil works structures. So similar to the O&M Contract the Owner should consider hiring a 3rd party to inspect the facilities.

163. Towards the end of the lease contract there should be some provisions for replacing worn equipment and making repairs so that facilities are handed back to the Owner in a fully operational condition

164. Technical O&M Programs and Documents. The Operator should maintain a computerized asset register and update the O&M manuals and records.

165. Customer Water Meters. Since the Operator's fee and profit are based on revenues, the Operator wants to make sure of accurate measurements for water provided and wastewater treated. This may involve installing two water meters in series, one owned by the Operator and the other owned by the Owner or the Customer. Since the meters are in series, both should show the same measurement. When there is a deviation exceeding a pre-agreed percent (for example 4%), then the meters are calibrated or replaced.

4.3.5.6 Financial Issues

166. Revenue Source. The main revenue source of the Operator is the tariff charged to service users.

167. Contract Components, Plant and Fee. The Operator is responsible for water supply transmission and distribution, full system O&M, and billing and collection within its lease area. The Owner, usually the water/wastewater service provider established to manage the system and facilities, ensures exclusivity of operation within the lease area, i.e. no other Operator, no competition.

168. For the capital investments in plant and facilities, the Owner will be paid by the Operator a lease or rental fee from the tariff revenue collected from customers. The lease fee is usually paid in escrow on the basis of achieved production volume, number of service connections, and reduction in non-revenue water (for older systems). On the other hand, the new facilities can be paid for by the owner and the investment can be recovered by the lease fee from the operator. The decision would be made subject to the cost of financing, i.e. who can provide the least expensive capital.

169. The contract requires Operator to finance plant renewals and expansion. At the end of the contract, e.g., 5-10-year term, the Owner compensates the Operator for the un-amortized portion of works and additions financed by Operator.

170. Tariffs and Collection. The Operator is involved in tariff setting and bears the risk if collection. Tariffs are cost-based and structured to cover all contractual obligations, i.e., settlement of contracted fee to Owner, and earn for the Operator a reasonable return. To minimize risks associated with collection, tariffs are designed bearing in mind customer affordability and willingness-to-pay. It is best practice to involve the customers in the whole process of tariff-setting, which starts from agreeing the type and level of services offered and the costs attached to achieving these. The Operator requires assurances about tariff levels and increases over the term of lease. There is need to establish a review and compensation mechanism if tariff levels do not meet projections.

171. Tariff Regulation. A regulatory body will perform periodic tariff review and tariff adjustment approval functions. The Operator, with support of Owner, submits tariff proposals with complete justifications, and in accordance with existing local guidelines relating to pricing utility services.

172. Other Financial Considerations. The lease contract is designed to incentivize the Operator to undertake best practice management measures to attain financial and commercial targets, including, among others: reducing O&M costs to maximize profits; reducing water losses to enhance supply; implementing commercial policies to increase customers, thus, the revenue base; continually updating customer files and profiles for more efficient collection procedures; and carrying out periodic maintenance to increase plant and equipment reliability, thereby extending service life and poWWTPone renewals.

4.3.5.7 Risk Allocation

Table 14 Risk Allocation for Lease Contract

Liability And Risk Distribution	Owner	Operator
Defect Liability Existing Equipment	X	
Defect Liability New Equipment		X
Care of the Assets		X
Insurance		X
Force Majeure	X	
Electrical Power		X
Terrorist or War Risks	X	
Change in Laws and Regulations	X	
Intellectual Property Indemnity		X
Insolvency by Owner		
Insolvency by Operator		

173. Force Majeure means circumstances arising and completely outside of the control and beyond the contemplation of the Parties to this Contract which renders its

performance impossible and frees the Parties from their respective obligations under the Contract. Examples of Force Majeure are war, insurrection, public disorder or riot; explosion, fire, earthquake, excessive and extraordinary floods; pollution of source water where such pollution has not been caused by an act or omission of the Operator; etc.

4.3.5.8 Summary of Option 5

174. Under a lease arrangement a private Operator leases the water and wastewater assets of the Owner and takes on the responsibility for operating and maintaining them. The lessor (Operator) effectively buys the rights to the revenues from the utility's operations (minus the lease payment), so the Operator assumes much of the commercial risk of the operations. Under a well-structured contract the Operator's profitability will depend on how much it can reduce costs while still meeting the quality standards in the lease contract), so it has incentives to improve operating efficiency.

175. Leases are most appropriate for existing facilities where there is the possibility of large gains in operating efficiency but only limited need for new investments.

176. For new facilities where the Owner is seeking private investment, then a lease can be combined with a mode of construction delivery, for example DBO.

177. The key issue of a lease contract is that the con-tractors' revenues are derived from customer payments and, hence, the question of tariff levels becomes increasingly sensitive. This may require structuring and revising complex tariff arrangements.

178. In addition, the responsibility for capital investment remains with the government and no private investment capital is mobilized.

4.3.6 Summary on the Discussions on the 5 options

Table 15 Comparison of PPP Options

No.	PPP Option	Finance	Risks/Cost			Value for Money (VFM)
			Technical		Operational	
			Design	Construction		
1	Design-Bid-Operate-Maintain (DBOM)	3. Borrowing money for construction (Procuring and labor costs). 4. Working Capital during operations period	Full responsibility (under defined responsibilities and obligations in the contract)		Full responsibility (under defined responsibilities and obligations in the contract)	4. Lower bid price gained from competition and less margin on each vendor's bid 5. Optimize the OPEX during the operations period. 6. Seamless transfer of risks from Design & Build phase to Operate.
2	Operations and Maintenance (O&M) with billing and collection services	Working Capital during operations period	No design risk/cost	No construction risk/cost	Full responsibility (under defined responsibilities and obligations)	4. Optimize the OPEX during the operation period. 5. Costs are highly transparent. 6. Optimize the value of assets by renewal of the facilities.
3	Operations and Maintenance (O&M)	Working Capital during operation period	No design risk/cost	No construction risk/cost	Full responsibility (under defined responsibilities and obligations)	4. Optimal the Opex during the operation period. 5. Costs are highly transparent. 6. Optimal the value of assets

No.	PPP Option	Finance	Risks/Cost			Value for Money (VFM)
			Technical		Operational	
			Design	Construction		
						by renewal of the facilities.
4	O&M (BOT future extension)	Working Capital during operation period except future investment	No design risk/cost	No construction risk/cost	Full responsibility (under defined responsibilities and obligations)	4. Optimal the Opex during the operation period. 5. Costs are highly transparent. 6. Optimal the value of assets by renewal of the facilities.
5	Lease	Working Capital during operation period and lease fee	No design risk/cost except latent defects	No construction risk/cost except latent defects	Full responsibility (under defined scopes, responsibilities and obligations); Demand risks; Tariffs collective risks;	5. Optimal the Opex during the operation period. 6. Costs are highly transparent. 7. Optimal the value of assets by renewal of the facilities. 8. Shift the demand risk.

179. Typically for DBO, the contractor prefers to gain profit from the DB stage rather than the Operation Phase, so the attractiveness of project depends on the scale of the construction, i.e. larger size projects are more profitable.

180. Usually for an O&M contract, the direct costs (e.g. chemical, electricity, etc.) and the administration costs are able to achieve savings by optimizing the management and operating procedure. Often the Opex can be reduced up to 15% depending on the capacity of the plant. Also there is a renewal cost incurred due to guarantee the performance of the equipment when the operator hands-over to owner at the end of contract. So, the benefits, VFM gained by the owner to outsource this type of the

contract are cost control and shift the risks (especially the compliance of discharge standard in water project).

181. For the Lease option, the profit margin to the operator comes from increased volume produced (water supply) or treated (wastewater) and the number of customers, as well as the optimization of the operations. For LCIP, it is quite dependent on the economic environment, national policy and strategy, and also the industrial output of the industrial park companies. For the industrial park, if the operator is a professional water/wastewater treatment company it may be able to generate an additional revenue by providing pre-treatment services for the individual companies in addition to the O&M of the centralized plants in LCIP. Then, the lease fee will be more or less like a concession fee to gain the right to manage the water supply and wastewater treatment business within the IP boundaries. The margin will be generated to deal with LCIP with a fixed fee but may have a significant increase of amounts come from the customers and additional services.

4.4 Recommending PPP Options for LIP

182. Considering the reality of LIP development and its development needs:

- Initial treatment volume of the water and wastewater facilities will probably be very low with the current confirmed industrial customers;
- Both LIP Management Committee and Jinyuan Water Supply & Drainage Company lack resources to organize the professional operation team;
- The individual plant operation services fee will be high;
- It is less attractive for the private operator as the operating revenue is low.

183. Based on these conditions, Option 1 - DBO procurement scheme is the most appropriate solution to fulfill needs of the construction and operation of the facilities in LIP. The assessment of Option 1 is in Table 16 below

Table 16 Further assessment of Option 1 – DBO

Commercial Assessment	• Simple Structure; • Clear interfacing; • Clear obligation & responsibility;
Technical Assessment	• Operator provides water and wastewater services according to contract standards for volume, pressure, water quality, and continuity (e.g. 24/7 services) • Operator is responsible for all human resource issues—hiring, training, discipline, payroll, etc. • Operator make repairs where necessary, but has no obligation to invest any money in equipment. • No gap on DBOM • O&M operator has to participate the T&C of the plant.
Financial Assessment	• LIPC awards contract to WSO with lowest O&M fee offer. • WSO earns from agreed fee paid by LIPC. • The cost includes, HR, power, chemicals, general maintenance, repair and overheads.

	• LIPC bears all tariff collection, demand other commercial risks. WSO focus on O&M efficiencies.
Base Fee Determination	• Calculated as summation of all unit O&M costs of production, expressed in CNY/m^3. • WSO estimates based on relevant O&M manuals and guidelines on technical specifications & norms to arrive at best offer. • Fee adjustment is based on periodic review which could be bi-annual as usual. • Risk balance between DB & OM cost (DBOM)

184. However, preliminary design of the proposed WWTP and wastewater pipelines in LIP has already been completed. From the view of project implementation, Option 1 may not be applicable for these components due to the actual project progress.

185. To solve the urgent need of LIP for professional O&M services, Option 3 – O&M (LIP to collect tariff from customers) is recommended for LIP for wastewater sector, which is simple in contract phase and easy to implement.

186. Therefore, further financial analysis is done for Option 1 and Option 3 s shown in Chapter 5 (or Appendix E). Both Option1 and Option 3 are financially viable, the tariff raising is within acceptable level.

5 FINANCIAL ASSESSMENT OF THE RECOMMENDED PPP SCHEME

5.1 Introduction

187. The proposed WS and WW development project for the LIP has been found financially viable under PPTA 8381-PRC[5]. As designated project Owner, Jingyuan County Government and LIPMC will be responsible for project implementation and operation. In the analysis, investments and assets buildup are public in nature and will be the responsibility of the Jingyuan County Government and LIPMC. Insufficient technical expertise in running a plant of this magnitude presents risks and the likelihood of failure. To mitigate, several options in the previous chapter have been considered and the most feasible is to out-source the operations to a qualified service provider. Existing laws allow this to be undertaken through PPP. This study investigated five PPP variants, of which two are deemed most appropriate – Option 1, through O&M management contract, and Option 3, through DBO. Technical, management and institutional assessments in the previous chapters have presented the advantages and disadvantages of both options. This chapter has taken technical assessment a step further by defining the financial implications upon Jingyuan County Government and LIPMC and their customers. The main objectives of the financial assessment are (i) to determine which PPP option would be the cheaper alternative to implement the water supply (WS) and wastewater (WW) treatment project in terms of costs and impact upon the LIP and their customers, and (ii) to determine the financial viability and sustainability of the options.

5.2 Assumptions

188. General assumptions used in the PPTA are applied in the financial evaluation of the PPP options. The analysis covers 25 years (2015-2040), including implementation period of 5 years (2015-2019). Full system operation starts in 2020 (Year 6). Price inflation rates are, for foreign cost, 2.7% in 2014, and 3.0% in 2015 and thereafter; and for local cost, 2.3% in 2014, 1.0% in 2015, and 1.4% in 2016 and thereafter. Project investment and O&M costs are price-adjusted to current 2015, as base price year. Major capital works include construction of WTP and WWTP and transmission, distribution and collection network, and provide for appurtenant works such as surveys, detailed design and construction supervision. O&M costs include personnel salaries, power and fuel, chemicals and agents, utilities, plant maintenance and repair, administration, taxes, and miscellaneous expenses.

189. Demands are as projected in the PPTA. Water and wastewater demand projections are based on water supply population of 38,848 in 2020 with daily water consumption per capita of 120 liters throughout the projection period for domestic use. Industrial water demand is based on type of industries and their typical daily water consumption based on the industrial demand assessment. Wastewater generation rate is 90% of water consumption. Project revenue will be derived from water sales and wastewater

[5] Gansu Baiyin Integrated urban Development Project.

treatment fees charged to service users within LIP and bordering areas. The Jingyuan County Government and LIPMC, as project financier, will ensure payment of loan obligations from all sources. Likewise, they will ensure satisfactory compliance with contractual obligations relevant to selected PPP option.

5.3 Cost Analysis

190. Best practice demands all standard direct expenses to operate and maintain the WSP and WWTP and pipe network would provide for O&M staff salaries, power and fuel, chemical treatment, repair and maintenance and miscellaneous costs. The direct costs have been estimated under the PPTA and updated in this study. The annual O&M budget estimated under the PPTA is presented in Table 17. The costs are given in current prices.

Table 17 O&M Cost Budget (in CNY million)

	O&M contract (5 years)							
	DBO contract (3 years)							
Particulars	2020	2021	2022	2023	2024	2025	2030	2040
Water supply	28.89	34.38	35.41	36.48	37.57	38.70	44.86	60.29
Salaries	2.59	3.09	3.18	3.28	3.37	3.48	4.03	5.41
Power	16.36	19.47	20.05	20.65	21.27	21.91	25.40	34.14
Treatment	0.40	0.48	0.49	0.51	0.52	0.54	0.63	0.84
Maintenance	8.05	9.58	9.87	10.17	10.47	10.79	12.50	16.81
Miscellanies.	1.37	1.63	1.68	1.73	1.78	1.84	2.13	2.86
Distribution	0.11	0.13	0.14	0.14	0.15	0.15	0.17	0.23
Wastewater	9.48	11.32	13.51	13.91	14.33	14.76	17.11	23.00
Salaries	0.48	0.57	0.69	0.71	0.73	0.75	0.87	1.17
Power	3.09	3.69	4.40	4.53	4.67	4.81	5.57	7.49
Treatment	1.07	1.28	1.53	1.57	1.62	1.67	1.94	2.60
Maintence.	3.89	4.64	5.54	5.71	5.88	6.05	7.02	9.43
Miscellan.	0.43	0.51	0.61	0.63	0.64	0.66	0.77	1.03
Collection	0.53	0.63	0.75	0.77	0.79	0.82	0.95	1.27
Total	38.37	45.70	48.92	50.39	51.90	53.46	61.97	83.29

191. In the analysis, the O&M budget is used as basis for estimating the O&M cost portion of the contract price. Under the two options, the Contractor will provide management expertise in O&M of the new plant. Expertise in O&M of plant provides an advantage to both project Owner and Contractor, as well as service users. The Owner

and service users are assured of quality service at presumably lower cost from proper care and maintenance of assets. On the other hand, the Contractor increases their margin resulting from cost efficiencies. For purposes of the analysis, cost efficiencies are calculated based on the following: 25% of labor wages, 10% of power consumption, 20% of treatment, and 10% of maintenance & assets renewal and miscellaneous costs, averaging 21-22% of total O&M cost for WS and WW.

192. It is assumed that aside from direct costs, the Contractor will incur general administration expense and will require compensation estimated at 25% of direct O&M cost, plus a fixed margin for profit calculated at 15% of direct O&M cost including administration expense for O&M contract, and 20% for DBO contract. The higher profit margin at 20% is justified for DBO Contractor who will ensure quality detailed design and construction supervision. Table 18 presents the cost matrix for the analysis of the two options.

Table 18 Cost Matrix of Preferred Options

Particular	CAPEX	OPEX
O&M	No private sector investment. Construction financing is Owner responsibility.	Direct O&M expenses include wages, power, chemicals, repair and maintenance, and miscellaneous costs.
		Experience in O&M creates efficiencies that translate into cost savings, and thus, profit to Contractor.
	No investment requirement for services extension or expansion, or future asset renewal.	Cost efficiencies assumed in the analysis: 25% staff salaries; 10% power; 20% treatment; 10% repair maintenance, assets renewal and miscellaneous.
		Assumed general administration expense at 25% of direct O&M cost..
		Assumed profit margin at 15% of direct O&M cost.
	Risk on physical asset during O&M period borne by Owner.	Experience in O&M limits, if not eliminates, risk factor.
DBO	No private sector investment.	Direct O&M expenses include wages, power chemicals, repair and maintenance, and miscellaneous costs.
		For the analysis, assumptions for cost efficiencies and general administration expense are same with O&M Contract.
		Assumed profit margin at 20% of direct O&M cost, to account for design and build quality..

	Expenditure for design engineering and construction supervision is let to Contractor	Risk on physical asset condition during O&M period and at turnover may be borne by Contractor as part of design-build quality assurance.

193. The total O&M cost for the 5-year contract amounts to CNY 235.29 million, with 73% allotted to water supply. Net of efficiencies, O&M cost for O&M contract is CNY 208.01 million, a savings of CNY 27.28 million. For DBO, the 3-year O&M cost amounts to CNY 133 million, 74% allotted to water supply. Net of efficiencies, this amounts to CNY 117.58 million, or a savings of CNY 15.42 million.

194. The total O&M contract cost is estimated at CNY 299.01 million, including administration cost and profit margin. The DBO contract cost is estimated at CNY 231.18 million, including administration, profit and design and build fee.

195. The contract costs for the two options are further analyzed to compare their equivalent in unit costs. Unit cost analysis more clearly reflects the impact of costs on tariff determination. Table 19 presents the cost comparison between O&M and DBO contracts, and Table 20 presents a comparison of unit costs and projected tariffs.

Table 19 Cost Analysis of Preferred Options

Particulars	O&M		DBO	
	Contract Cost /1 CNY mill	Unit Price /2 CNY/m^3	Contract Cost /3 CNY mill	Unit Price /2 CNY/m^3
O&M Cost - Direct /4	235.29	1.24	133.00	1.20
Water	172.73	1.35	98.69	1.31
Wastewater	62.55	0.94	34.31	0.91
O&M Efficiencies /5	27.28	0.14	15.42	0.14
Water	19.84	0.15	11.34	0.15
Wastewater	7.44	0.11	4.08	0.11
Gen. Administration /6	52.00	0.27	29.40	0.27
Water	38.22	0.30	21.84	0.29
Wastewater	13.78	0.21	7.56	0.20
Design & Build cost /7	-		45.67	0.40
Water	-	-	28.06	0.37
Wastewater	-	-	17.61	0.47
Profit Margin /8	39.00	0.21	38.53	0.35
Water	28.67	0.22	27.45	0.36
Wastewater	10.33	0.16	11.08	0.29
Total Cost	299.01	1.57	231.18	2.07
Water	219.78	1.71	164.70	2.18
Wastewater	79.23	1.19	66.47	1.77

1/ Based on 5-year O&M contract.

2/ Based on water and wastewater production.

3/ Based on 3-year DBOM contract.

4/ Includes direct O&M expenses - staff salaries, electricity, chemicals, maintenance and miscellaneous expenses.

5/ Efficiencies translate into savings and thus profits to Contractor.

6/ Estimated at 25% of direct O&M cost.

7/ Based on investment cost for wastewater and water supply network.

8/ Estimated at 15% of direct O&M cost calculated for 5-year O&M contract, and 20% of direct O&M cost for DBOM contract.

Table 20 Comparison of Unit Prices and Tariffs

Particulars	Unit Price /1 CNY/m^3	Initial Tariff /2 CNY/m^3	Average Tariff /3 CNY/m^3	Average Tariff /4 CNY/m^3
O&M	1.57	2.48	2.64	3.50
Water	1.71	2.82	2.99	3.97
Wastewater	1.19	1.27	1.35	1.79
DBO	2.07	2.53	2.54	3.62
Water	2.18	2.87	2.87	4.09
Wastewater	1.77	1.29	1.29	1.84

1/ Based on water and wastewater production.
2/ Based on tariff in Year 2020, initial year of full operation.
3/ Based on 5-year and 3-year contract period for O&M and DBOM, respectively
4/ Based on tariff requirements during 25-year study period.

196. Unit cost analysis shows that generally, contract prices are within projected tariffs, except in the case of wastewater under DBO, where unit price at CNY 1.77/m^3 is higher than the initial projected tariff and the 3-year average tariff, both at CNY 1.29/m^3. However, the unit price for the total DBO contract at CNY 2.07/m^3 is still within the initial tariff at CNY 2.53/m^3 and the 3-year average tariff at 2.54/m^3. Although higher than the unit price of O&M contract at CNY 1.57/m^3, the DBO total cost requirement under a shorter 3-year term requires lower average tariff, this despite the design-build cost item.

5.4 Financial Analysis

197. Projected tariffs. The existing tariff in Jingyuan County has been used as basis for projecting succeeding tariffs that would support project investment and operations. The tariffs are acceptable to existing service users. The analysis concluded that initial adjustments are required to ensure capital and operating cost recovery and to provide for contractual obligations under the proposed PPP approach to O&M and project development. Table 21 presents the projected tariff schedule for the two options.

Table 21 Projected Tariff (in CNY/m^3)

Particulars	O&M/DBO /1	2020	2021	2022	2023	2024	2025	2030	2040
O&M	2.64	2.48	2.49	2.49	2.86	2.86	2.86	3.20	3.20
Water	2.99	2.82	2.82	2.82	3.25	3.25	3.25	3.63	3.63
Wastewater	1.35	1.27	1.27	1.27	1.47	1.47	1.47	1.64	1.64
DBO	2.54	2.54	2.54	2.54	2.95	2.95	2.95	3.32	3.32
Water	2.87	2.87	2.87	2.87	3.33	3.33	3.33	3.75	3.75
Wastewater	1.29	1.29	1.29	1.30	1.50	1.50	1.50	1.69	1.69

1/ Based on O&M contract of 5 years, and DBO contract of 3 years.

198. **Impact on Owner finances**. Tariff sales will be the main source of revenue from operations. Tariff billing and collection will be a function of the Owner, but may likewise be assigned to Contractor, who will most likely require service fee for the additional

task. Owner will pay Contractor operating fee and fixed profit margin out of tariff collections.

199. **Profitability**. The analysis shows sufficient revenues generated under both options to pay all cash requirements including Contractor fees, depreciation and loan interest expenses and taxes. This reflects profitable operations and may be measured using the operating ratio (i.e., ratio of operating costs to revenues), where a ratio less than 1.0 suggests profitability for the Owner; the lower the ratio, the greater the profitability.

200. Under O&M option, revenues will grow from CNY 68.25 million in 2020 to CNY 93.93 million in 2024, when O&M contract expires. Assuming the contract is renewed indefinitely, revenues will result in annual net incomes ranging between CNY 5.67 million (2026) and CNY 17.94 million (2035) during the period 2026 to 2040. Operating ratio reflects profitability at between 0.7 and 0.8.

201. Under DBO option, revenues will grow from CNY 69.45 million in 2020 to CNY 83.10 million in 2022, when DBO contract expires. If contract extends indefinitely, revenues will increase from CNY 96.40 million in 2023 to CNY 145.95 million by 2040. The resulting operating ratio is between 0.7 and 0.8 throughout the period.

202. **Financial viability**. In the analysis, viability is measured by the financial internal rate of return (FIRR), which should be higher that the weighted average cost of capital (WACC) that ensures Owner capacity to settle all financial obligations. The WACC is estimated at 2.5% (per PPTA). The resulting FIRRs under O&M contract and DBO are 3.9% and 3.7%, respectively, which render the project under either option to be financially viable. The FIRR measured under PPTA is at 3.5%. The differences are mainly due to higher tariff requirements to implement either option.

203. The proxy measure, financial net present value (FNPV), should be positive. The analysis of options showed FNPV for O&M contract at CNY 131.91 million, and for DBO at CNY 108.20 million. FNPV estimated in PPTA is CNY 87.10 million.

204. **Tariff affordability and impact on service users**. The resulting tariffs have been subjected to affordability analysis where the tariffs are measured against household income. A ratio is less than 4-5% reflect tariff affordability.

205. Based on PPTA, the average household income in 2015 is CNY 4,665 per month (updated). Average income is projected annually following GDP trends. Based on the analysis, WS and WW tariffs under both O&M contract and DBO options range from 0.4% to 0.6%. Tariff projected in PPTA are from 0.3% to 0.6%.

5.5 Summary Findings

206. There will be opportunities for O&M efficiencies under both options. Efficiencies would result in savings that convert to profits for the Contractor. In turn, this will incentivize the Contractor to improve their level of efficiency to justify contract extension. Likewise, the Contractor can improve their chances for subsequent contract renewal with lower bid price based on experience at efficient and quality operations.

207. Based on unit cost analysis, the cheaper alternative is the O&M contract at CNY 1.57/m^3 compared to DBO at CNY 2.07/m^3. However, in terms of impact on projected tariff, the shorter-term DBO contract prevails as the cheaper option as the average tariff required is CNY 2.54/m^3 compared to that of O&M contract at CNY 2.64/m^3.

208. Both options are sustainable for the Owner at the proposed tariff schedule. Operating ratios are acceptable at 0.7-0.8 under both options throughout the study period. The resulting FIRRs at 3.9% under O&M contract and 3.7% under DBO show that both options are financially viable, having exceeded the WACC at 2.5%.

209. Tested for affordability, the projected tariffs, which are found to be within the acceptable limit of 4-5% of household income, are deemed acceptable to the public and will contribute to long-term viability.

6 CONCLUSION

210. Based on the priority of its study and its obligation to attract investment for LIP development, LIP management committee should focus on providing sufficient support and service for the industrial customers:

- Maintain the integrity of ADB funded assets and facilities and to integrate them with the future planning and development strategies.
- Improve the basic services and conditions, and facilitate a favorable environment for investment and future development.
- Strengthen the government's role and the concept of public administration and regulation.

211. It is recommended outsourcing the water and wastewater services to a specialist company who would operate the facilities according to defined performance targets and achievement levels.

- Select a simple structure with social participating model, to clarify the responsibilities and obligations by contractual agreement.
- Have one specialist company for both water and wastewater services
- At the end of the contract period, choose to terminate, renew, or modify the business model or management mode.

212. To address LIP's needs, Option 1 - DBO procurement scheme will be the most appropriate solution to fulfill needs of the construction and operation of the facilities in LIP. In DBO contract, the contractor will be responsible for the design, construction and operation of the facility and also bear the technical and operational risk during the contract period. In addition, when design, construction and operation are handled together from the outset, there are more opportunities for efficiency. However, the ownership of the facilities will still be with LIP.

213. However, as we understand, preliminary design of the proposed WWTP and wastewater pipelines in LIP has already been completed. From the view of project implementation, DBO may not be applicable for these components due to the actual project progress.

214. To solve the urgent need of LIP for professional O&M services, Option 3 – O&M (LIP to collect tariff from customers) is recommended for LIP for wastewater sector, which is simple in contract phase and easy to implement. While, Option 1- DBO can be applied for Water Supply service in LIP. Combination of DBO and O&M can effectively solve the current needs of LIP and assist LIP to achieve long term sustainable development.

SD-6 PRIVATE PUBLIC PARTNERSHIP

Appendix A Study Tour Report

Report on site visits to Hefei Wangxiaocheng WWTP and Shanghai Chemical Industry Park WWTP

CONTENTS

1. INTRODUCTION

Since the PPP team provided the inception workshop & training for Baiyin PMO & LCIP at the end of May of 2014, ADB offered a site visit for PMO in order to let them have a deeper understanding of PPP and help them find an appropriate PPP approach to apply for the water and wastewater projects in Liu Chuan Industrial Park (LCIP).

In addition, it would be an opportunity to expose the project to some of the key market players through this site visit. AECOM was commissioned by ADB to organize the meeting with Berlinwasser China Holding Company and SINO French Water Development Company Ltd and site visits to theirwastewater treatment plants:

- Hefei Wangxiaoying Wastewater Treatment Plant (in Anhui Province), and
- Shanghai Chemical Industry Wastewater Treatment Plant (in Shanghai)

A two-day visit was therefore conducted on 5th and 6th November 2014. This report summarises the key points during thediscussions with operation staffs on site as well as the wrap-up meeting with the PPP & PPTA consultants from AECOM.

Name List of the Delegation

S/N	Name	Gender	Organization	Position
1	Zhou Jianhua	Male	Baiyin PMO	Deputy Director
2	Li Shichun	Male	Baiyin Financial Bureau	Deputy Director
3	Liu Zaijun	Male	Jinyuan County Government	Deputy County Head
4	Wang Jianquan	Male	LCIP Management Committee	Director
5	Zhang Shixiong	Male	Baiyin PMO	Engineer

2. HEFEI WASTEWATER TREATMENT PLANT

2.1. Overview of the Project

According to the introduction provided by Ms. Zhang, the plant General Manager of Hefei Wangxiaoying WWTP (HWXY WWTP), which is located at Hefei city, Anhui province in China, the WWTP was constructed in two phases. The phase 1 WWTP was designed with a capacity of 150,000m^3/d and started operation in 1998 (total investment amounted to 177 MRMB). The phase 2 WWTP of capacity 150,000m^3/d (total investment of 140 MRMB) started operation in 2001, which increased total throughput capacity to 300,000m^3/d.

In 2004, a TOT contract with 23-year concession was awarded to Berlinwasser China Holding (BCH), with a purchase price of 460 MRMB (50 % premium on asset values).

There are currently 11 sewage treatment plants in Hefei, with a total capacity of 835,000 m^3/d, all operated by private companies through various PPP models in terms of TOT, BOT and Delegated Management.

Fig. 1: Layout of HWXY WWTP

Currently, the treated effluent of Wangxiaoying WWTP is required to achieve Discharge standard of pollutants for municipal wastewater treatment plant (GB 18918-2002 Class 1A standards) (Table 1).

Effluent Requirement	Discharge standards	Actual treated effluent
BOD_5 (mg/l)	≤ 10	5
COD_{cr} (mg/l)	≤ 50	30
TSS (mg/l)	≤ 10	10
TN (mg/l)	≤ 10	≤ 20
TP (mg/l)	≤ 1	≤ 1
E-Coli (counts/L) note 2	10^3	N/A

Table 1: Class 1A Effluent discharge standard of GB 18918-2002

Treated effluent from the WWTP is discharged into two locations: Chao lake and another downstream discharge point from the WWTP.

Currently, there is a total of 60 staffs employed in Hefei Wangxiaoyingg WWTP. The General Manager was transferred from the Governmental Sewage Bureau at the beginning of the project.

2.2. Process Description in Brief

Both phase 1 and phase 2 of the WWTP was designed using conventional oxidation ditch technology (Figure 2). The phase 1 WWTP adopts conventional brush aerators and the phase 2 WWTP adopts disc aerators.

Fig. 2: Oxidation ditch with brush aerators (phase 1 plant)

A simplified process flow diagram is depicted in Figure 3.

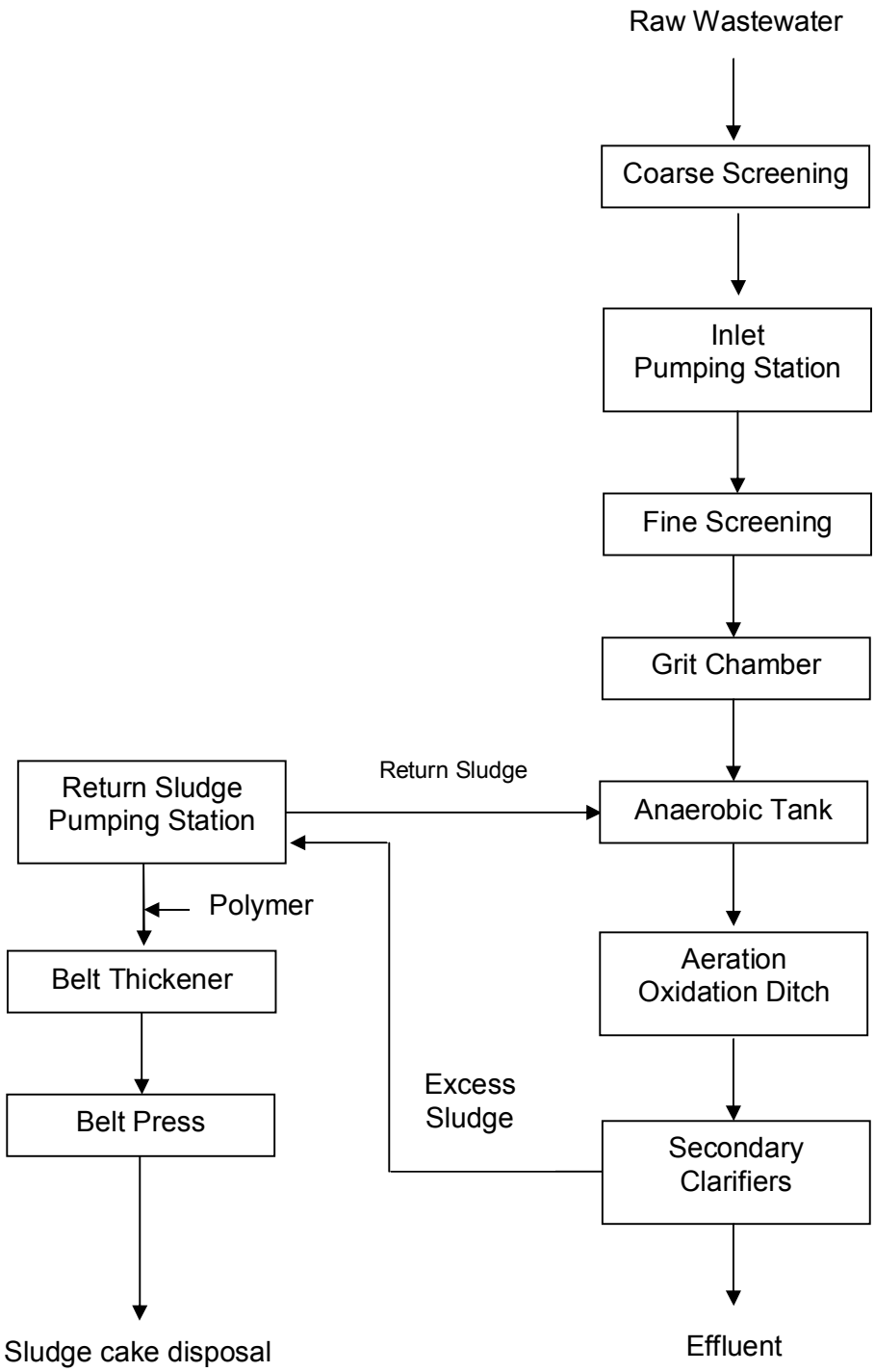


Fig 3: Simplified process block flow diagram

2.3. Current Upgrading Works

Due to rapid development of the city, various residential buildings are constructed around the WWTP. In order to address impacts on the surrounding residents due to issues arising from noise/odour generated from the WWTP and to escalate treatment standards to minimise

pollution in receiving water body at Chao lake, the local government has invested various works to upgrade the WWTP:

- ***Works to minimise odour and noise impacts:*** The scope of odour reduction works include covering the pretreatment units and anaerobic tanks, and construction of a new biological deodourisation facility with ancillary collection pipeworks. Details of the noise reduction works include covering motors of phase 1 aerators and covering effluent launders of clarifiers for the whole WWTP.

- ***Upgrade of Phase 2 oxidation ditches:*** The scope includes conversion of oxidation ditches to A2/O ditches with anoxic zones (total tank volume remain unchanged), and replacement of disc aerators to fine bubble aerations with air blowers.

- ***Upgrade to tertiary treatment to achieve the effluent discharge from 1B to 1A discharge standards and GB 3838 Class IV surface water quality:*** According to this upgrade works, a very stringent discharge standard with Class IV surface water standards will be imposed on the effluent discharge location at the Chao lake. It means that the treated effluent is required to be decolorized and TN concentration shall be lower than 5mg/l.

In parallel, Class 1A discharge standards will be imposed on another downstream discharge point. The treated effluent shall meet CODcr≤ 50mg/l, BOD_5 ≤ 10mg/l, TSS≤10mg/l, TN≤10mg/l and E-Coli ≤10^3 counts/l.

In view of these stringent requirements, the government has carried out pilot studies to evaluate various treatment processes' robustness. The pilot studies included denitrification biofilters from different suppliers (Seven Trent, BAF) and continuous sand filters (Paques) etc.

Fig 4: A dismantled pilot equipment (from Paques) used for pilot study

After the pilot studies, the process upgrade for tertiary treatment is shortlisted as follows:

i. A treatment process with a design capacity 100,000m3/d comprising denitrification biological aerated filters + V-shape sand filters (by utilizing an existing effluent polishing plant which is located around the WWTP and operated by government) + ozonation (for decolorisation) + sodium hypochlorite disinfection will be constructed to meet Class IV surface water standards for treated effluent discharging into Chao lake.

ii. A treatment process of capacity 200,000m^3/d comprising continuous sand filtration (Paques) + UV disinfection will be constructed to meet Class 1A standards for effluent discharging into downstream point.

At present, the upgrade works on noise/odour and phase 2 oxidation ditches was been completed in mid. of 2014. (Figure 5 and 6), Berlinwasser anticipates to take over the upgrade works when it is commissioned and will then start to negotiate with the government at a later stage.

At the moment, Berlinwasser also expected that the upgrade works would result in certain OPEX saving with use of high efficient fine bubbles aeration equipment in phase 2 oxidation ditches even if there is slight increase in odour treatment cost.

Fig 5: Covered anaerobic tanks and de-odourisation unit (left), covered clarifier (right)

Fig 6: Modification works at Phase 2 oxidation ditches (left), new ABS magnetic bearing air blower (right)

The Wangxiaoying WWTP is the first sewage treatment plant in Hefei being upgraded by the government.who The Hefei government is planning to upgrade two more plants at a later stage.

2.4. Summary of the site discussion

The experience shared by the plant General Manager are as follow:

- It is an extremely important issue to verify the treating volume of water/wastewater on outsourcing service project;
- The “Take or Pay” is a common methodology to determine the service fee providing from private operator. “Step tariffs Vs treated volume” is one of the methodology to claim for the new treatment plant like LCIP.
- The asset transfer of the Wangxiaoying TOT contract will be free of charge transfer to the government but it will be set up for a handover period at the last two years in order to ensure the equipment to be handed over in normal operating performance.
- The staff transfer to the project have been kept the retirement scheme base on SOE’s employee scheme.

3. SHANGHAI CHEMICAL INDUSTRY PARK WASTEWATER TREATMENT PLANT (SCIP WWTP)

3.1. Overview of the Project

SCIP WWTP is located at Shanghai Industry Park, Shanghai Pudong in China. The WWTP was implemented by the Joint Venture Company formed by SCIP Development Company & SCIP Investment Company and SINO French Water Development Company Ltd under a50-year concession contract to providing full water cycle management service in the industry park.

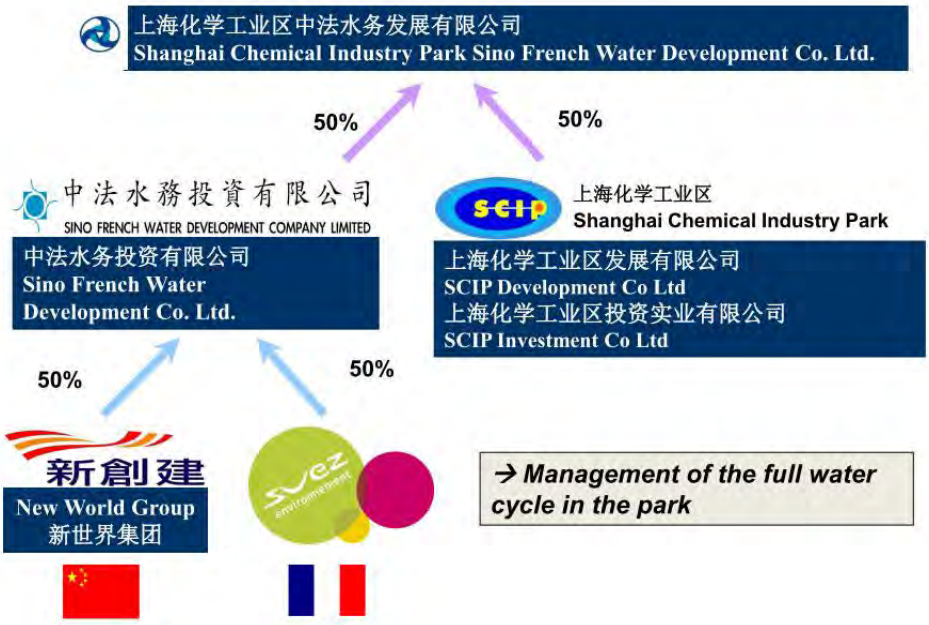


Fig 7: Organizational Structural of the JV

The potable water and the industrial water treatment plants were designed with the capacity of 7,000m^3/d & 100,000m^3/d respectively.

The treating capacity of the WWTP is 35,000m^3/d with 30% water reuse purpose and expects to extend the capacity up to 50,000m^3/d in 2016.

The process streams of the wastewater treatment plant are receiving the wastewater discharge from the factories by 20 pipelines that ensure each streams are able to cater different pollutants and comply with the discharge standard.

Currently, the plant is equipped with sludge incineration facilities with energy recovery for the public utilities.

Fig 8: Layout of SCIP

3.2. Process Description in Brief

Water Treatment Plant

The raw water of the water treatment plant is from Shanghai Jinhui Harbour. Common portable treatment process is adopted in this plant.

Wastewater Treatment Plant

As mentioned in the previous paragraph, the process streams of the wastewater treatment plant are receiving the wastewater discharge from the factories by 20 pipelines. The wastewater treatment process also varies according to different influent quality by combination of various treatment units. Advanced on-line monitoring equipment (esp. online toximeter) is installed to closely monitor the influence quality and ensure the stable operation of each unit.

Fig 9: WWTP Layout

Partial of the wastewater effluent (around 30%) goes through tertiary treatment for water reuse. The tertiary treatment processes involve sand filtration, RO and ion exchange. The high quality reclaimed water is used for boilers in the industrial park.

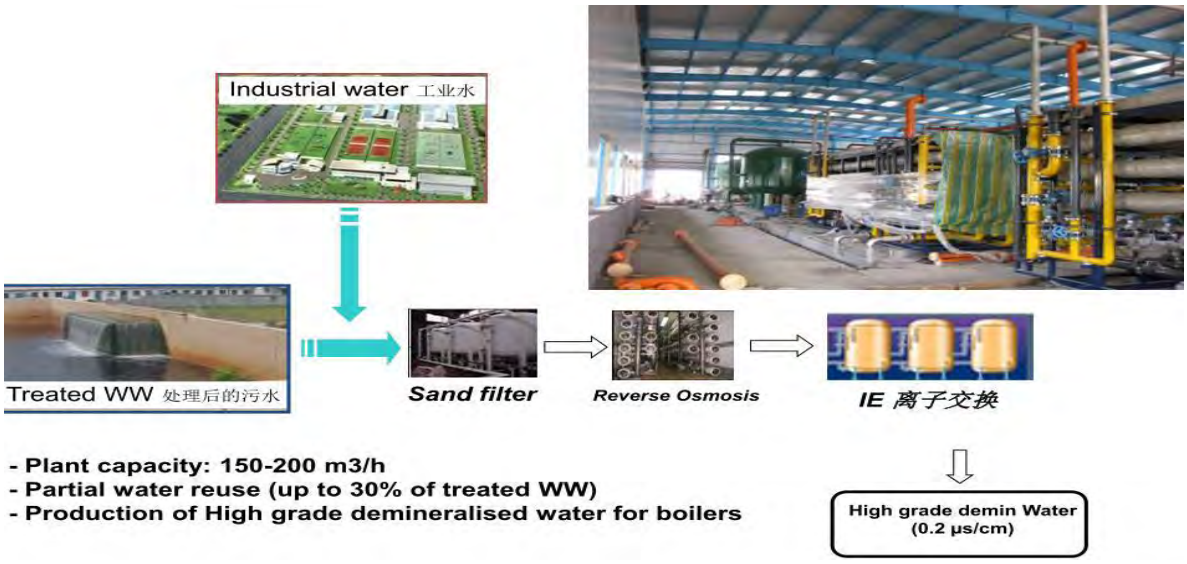


Fig 10: Water Reuse in SCIP

3.3. Current Upgrading Works

Water Treatment Plant

The expansion of the water treatment plant is ongoing. The industrial water supply capacity will be expanded from 100,000 m^3/d to 200,000m^3/d.

Wastewater Treatment Plant

A High salinity treatment line was constructed in 2012 to tackle the high salinity wastewater (e.g concentrated cooling water) generated from the SCIP. The treatment capacity of this line is 4000m^3/d. The treatment capacity will be further expanded in 2017.

The treatment capacity was upgraded from 21,600 to 35,000 m^3/d in 2013 with more equalization capacity added.

3.4. Summary of the site discussion

The plant General Manager, Mr.Jean-Pierre Arcangeli answered the questions raised from Baiyin's Delegation are as follow:

- The structure of the project operation was organized by the SCIP Development Company which is formed by the public-private sector.
- SINO French will be interested to participate in the operation of the industrial parks which are the Fine chemical, rare earth, coal chemical.

4. CONCLUSIONS AND RECOMMENDATIONS

1. In general, Baiyin delegations are satisfied with the site visit and learned a lot of experience from the visiting projects.
2. In principle, the delegation believe that there will be a trend of PPP for outsource the w/ww services in the future which not just limit to LCIP but also Jiayuan as well as Baiyin.
3. The delegation invites PPP team to provide the second training for the officials, which will be led by the Country Director of the Jianyuan in next two weeks.
4. The delegation expects PPP team to help them study various feasible options of PPP for their further consideration and will implement the PPP while the time comes.

Asian Development Bank

亚行贷款甘肃白银市城市发展二期项目

Gansu Baiyin Urban Development II Project by ADB

PPP方案座谈会

PPP model Workshop

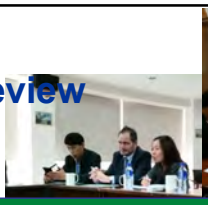
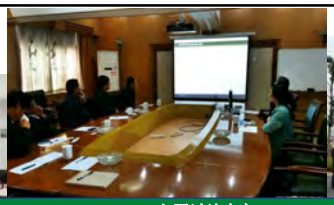
汇报人： Consultancy Team

日期： 25/NOV/2014

工作回顾 Tasks Review

主题 (Topic)	培训内容 (Key content)	项目阶段 (Stage)	建议参加人员 (Participant)
探讨各种PPP模式 (Identify various PPP scheme)	• 介绍PPP的基本概念和操作过程 • 探讨本项目的需求和可行的模式 • Introduce the principles of PPP and its implementation; • Identify the need and the feasible structure of this project.	启动阶段 Inception Workshop	BMG/LIP 项目小组 (done by 28-May-2014)
市场探索/考察 (Market Sounding/ Site Visit)	• 参观合肥王小郢污水处理厂（11月5日） • 参观上海化工园（11月6日） • 总结会议及下一步行动计划 • Visit Hefei Wangxiaocheng STP on 5-Nov • Visit Shanghai Chemical Industry Park on 6-Nov. • Review meeting of the visit and further action plan	市场调查/现场考察 Market Sounding / Site Visit	BMG/LIP 项目小组 (done by 6-Nov-2014)
确立适合的PPP模式 (Defining the appropriate PPP scheme) **PPP方案执行 (Project Execution)**	• 从技术、财务、商业运作进行分析 • 确立适合本项目的可行模式 • 介绍招标文件及服务协议纲要草案; • Conduct technical, financial, and commercial analysis • Define an appropriate PPP scheme; • Introduce the principles of the service contract & bidding document; • 总结方案及制定目标计划 • 确立项目的执行日程及工作 • Conclusion & develop the mission schedule; • Define the implementation program and work plan	终期阶段 Final Workshop	BMG/LIP 项目小组 Expect to be held at the End of Dec

工作回顾
Tasks Review


日期 Date	主要讨论内容 Key Discussion
11月5日 参观合肥王小郢污水厂 柏林水务 5-NOV Visit Wangxiaocheng STP, Hefei Berlinwasser	1. 在外包服务项目中，确定供水/污水量是非常重要的。 2. “必购必付”是确定私营运营商服务费的一种常用的方式。“阶梯水费 vs. 处理量”是对新的处理设施（如刘川工业园）的一种收费方式。 3. 王小郢污水厂的TOT合同中，合同期满将以无偿移交给政府。且在合同期满前会设立一个最后两年过渡期来验证设备的运行良好。 4. 这个项目的员工继续享受国有企业员工退休待遇 1. It is an extremely important issue to verify the treating volume of water/wastewater on outsourcing service project; 2. The “Take or Pay” is a common methodology to determine the service fee providing from private operator. “Step tariffs Vs treated volume” is one of the methodology to claim for the new treatment plant like LCIP. 3. The asset transfer of the Wangxiaoying TOT contract will be free of charge transfer to the government but it will be set up for a handover period at the last two years in order to ensure the equipment to be handed over in normal operating performance. 4. The staff transfer to the project have been kept the retirement scheme base on SOE’s employee scheme.
11月6日 参观上海化工园项目 中法水务 6-Nov Visit SCIP, SINO French	1. 该项目的运行架构是由上海化工园发展公司（公私合作）来制定的。 2. 中法水务有兴趣参与精细化工、稀土、煤化工类型的工业园 1. The structure of the project operation was organized by the SCIP Development Company which is formed by the public-private sector. 2. SINO French will be interested to participate in the operation of the industrial park which are the Fine chemical, rare earth, coal chemical.

PPP方案座谈会

PPP Model Workshop

目录

1. 白银项目的现 况
2. 靖远供水及污水处理的现况
3. 外包供水及污水处理服务的必要性
4. 托管运营模式及租赁模式的介绍
5. 从法律 、 技术 、 营运及财务的各种考虑要素
6. 建议
7. 下 一步的执行计划
8. 投标及法律文件的主要事项

Presentation Outline

1.Current Situation of Baiyin Project

2.Current status on water supply & sewage services in Jingyuan

3.Necessity of Outsourcing the Water and Sanitation Services

4.Describe O&M and Leasing options

5.Considerations on legal, technical, operational ,and financial components

6.Recommendations

7.Implementation Plan and Next Steps

8.Key elements of the tender documents and contractual issues

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白银项目的PPP 方案
Baiyin PPP scheme

靖远供水及污水处理的现况
（Current Status of Water Supply and Sewage treatment Services in Jingyuan）

	靖远县吴家湾水厂 Jingyuan County Wujiawan WTP	靖远县城区污水处理厂 Jingyuan County Urban WWTP
Distance to LIP 离刘川工业园距离	18 km	20 km
Design Capacity 设计规模	30,000 m3/d	10,000 m3/d
Production Capacity 生产量	10,000 m3/d	5,000 m3/d
Commission date 投运时间	2003年9月 September 2003	2011年11月 November 2011
Construction costs 建设成本	138,900,000	42,300,000
Number of staff 员工人数（运行）	61人	30人
Ownership of the assets 资产所有权	靖远县给排水公司 JY W/WW Co	靖远县给排水公司 JY W/WW Co
O&M entity 运行单位	靖远县给排水公司Jingyuan County Water and Wastewater Company	靖远县给排水公司Jingyuan County Water and Wastewater Company
Service Area Coverage 服务范围	30 km2	10 km2

白银项目的PPP 方案
Baiyin PPP scheme

靖远供水及污水处理的现况
（Current Status of Water Supply and Sewage treatment Services in Jingyuan）

靖远县给排水公司的设施运行人员配备 Operational Staffs of Jinyuan County Water Supply and Sewage Company	每星期7天 每天24小时 7days per week 24 hours per day
员工培训机制 Staff Trainning	在职 On Job
安全程序的建立 Safety SoP	没有 No
靖远县给排水公司维修检测诊断装备 Maintenance and Trouble Shooting Devices	缺乏 Lack of
靖远县给排水公司采用计算机进行数据管理、资产管理 Computerized Information Management & Asset Management	没有 No

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白银项目的PPP 方案
Baiyin PPP scheme

白银供水及污水处理项目的内容
(Scope of the Baiyin Water and Sanitation Project)

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白银项目的PPP 方案
Baiyin PPP scheme

白银供水及污水处理项目的内容
(Scope of the Baiyin Water and Sanitation Project)

一座日处理量60,000m3/d的市政供水厂	a new water supply plant of 60,000m^3/d treatment capacity
14公里长的原水输水管线、13.97公里的供配水管网与相关设施;	a 14-km raw water transmission pipeline, a 13.97-km water distribution pipeline network with related facilities;
一座日处理量35,000m3/d的市政污水处理厂	a new wastewater treatment plant of 35,000m^3/d treatment capacity
40.035公里长的污水收集管网与相关设施;	a 40.035-km wastewater collection pipeline network with related facilities;

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白银项目的PPP 方案
Baiyin PPP scheme

白银供水及污水处理项目的挑战
(Challenges on Baiyin Water and Sanitation Project)

发展的不确定行 （如，需水量，宏观经济的影响…）	Uncertainties on the development (eg. Water Demand, Macro-Economy factors)
缺少专业人士的支持 （如，合格的运行人员，应急管理…）	Lacks of professional support (eg. Qualified operator, emergency management)
可持续发展 （如，资产管理，未来的融资…）	Sustainable development (eg. Asset management, future funding)
风险分配 （技术、财务、运行）	Risk Allocation (Technical, Finance, Operational)

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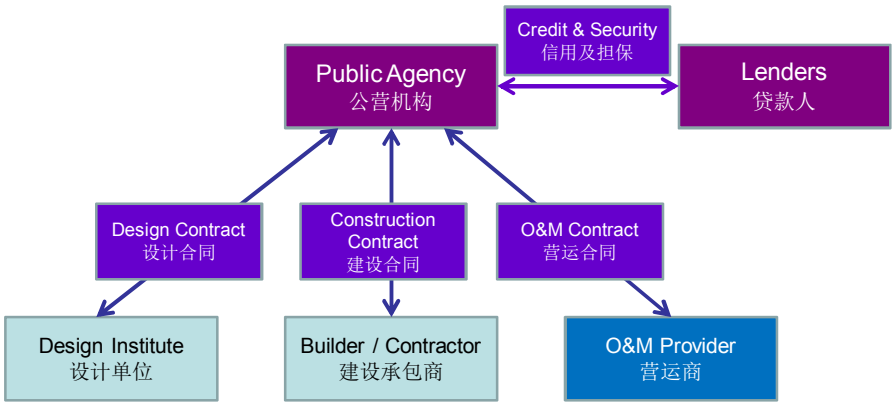
白银项目的PPP 方案 Baiyin PPP scheme

白银供水及污水处理项目的需求
(Needs of the Baiyin Water and Sanitation Facilities)

资产所有权和管理： a)资产所有权的完整性。 b)产权的变更 /转让 必须获得亚行的同意。 c)需要有经验的运营团队来管理和运行贷款建设的设施。 d)需要有服务企业经验的管理团（*无间断供水、应急事故处理，泄漏、排放事故*.....等)。 e)分担经营风险。 f)技术能力。	**需求** (a) 需要专业的操作人员。 (b) 风险转移。	Asset Ownership and Management: (a) Integrity of the assets ownership. (b) Change/transfer of ownership must be approved by ADB. (c) Necessity of an experienced operation team to manage and operate the ADB financed facilities; (d) Necessity of an experienced management team to serve the industrial customers. (*No interruption of water supply, emergency accident handling, leakage, discharge incident, etc.)* (e) Share the operational risk. (f) Technical capability.	Needs (a) Professional operator is need. (b) Risk transfer.
未来的新增投资： a) 污泥处置; b) 再生水利用 c) 园内的个体工业客户。 d) 配水/收集管网 e) 升级改造	**需求** (a)利用拥有的资产 (b) 融资，贷款，抵押。 (c) 共同投资者。	Future New Investment: (a) Sludge disposal scheme; (b) Recycling Water; (c) Services for Individual Industrial customers. (d) Distribution/collection pipe-works. (e) Technical Upgrading	Needs (a)leverage owned asset (b)financing, loan, mortgage. (c)co-investor.

白银项目的PPP 方案
Baiyin PPP scheme

白银供水及污水处理项目结构
(Structure of the Baiyin Water and Sanitation Project)



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白银项目的PPP 方案
Baiyin PPP scheme

外包供水及污水处理服务的必要性
(Necessity of Outsourcing the Water and Sanitation Service)

每个城市/ 地区**外包公共服务**的原因各有不同。根据我们的经验，各地方把自来水与污水服务**外包**有以下一些主要原因：
Major reasons for outsourcing water and sanitation services include:

技术原因： ❑从技术和管理知识中受益 ❑在公共卫生和环境保护等敏感领域获得技术与法律方面的保证 ❑得益于最好的专业技能、更新及研究力量	**Technical reasons:** ❑Benefit from technical and managerial knowledge ❑Assurance of complying with the technical and legal requirements of public health and environmental protection insensitive areas ❑Gains the best professional skills, updates ,and research support.
人力资源方面的原因: ❑得益于专业机构，以激励、保持并吸引员工（培训、工作的灵活性、研发等） ❑有效地组织公司的人力资源	**Human Resources reasons:** ❑Gain from the professional company to motivate, retain, and attract employees (training, work flexibility, research and development, etc.) ❑Effective utilization of human resources

白银项目的PPP 方案
Baiyin PPP scheme

外包供水及污水处理服务的必要性
(Necessity of Outsourcing the Water and Sanitation Service)

价格控制 ❑通过成本控制保持可支付的水/污水费 ❖私营机构通常反应性增强(结构性的地方义务并非强制性的) ❖专业型的机构可以优化采购 ❖更高的技术专业知识可以优化化学药品和能源消耗 ❑对水/污水费的进行优化管理 ❑水/污水费的长期可预见性	**Tariff controls** ❑To maintain the affordability for the Opex in water / sewage by cost control ❖The private sector is response sensitively (obligations are not mandatory in local) ❖Professional operator can optimize the procurement ❖Professional technical expertise to optimize treatment chemical and energy consumption ❑To optimize the management in tariffs. ❑Tariffs can be predictable for long term operation.
为将来设施的建设融资 ❑通过更好的运营以降低所需基建投资 ❑进行基建投资并平衡其影响 ❑优化性价比	Financing for the future construction of facilities ❑Reduce the demand for new infrastructure investment by optimizing current operations. ❑For infrastructure investment and balance its impact ❑Cost optimization

公私合作伙伴(PPP)模式

私企责任 Responsibilities of Private Sector：

	DBO DBO	Concession 特許经营	Lease 租赁	O&M 托管合同
Assets ownership 资产拥有	No 没有	Yes/No 有(新)/没有	No 没有	No 没有
Investments投资	No 没有	All 所有	Renewal if necessary 更新(如需)	No 没有
Operation and maintenance营运管理	Treatment Plant (TP) 一般只有处理厂	All 所有	TP to all 厂/所有	TP 一般只有处理厂
Duration (years) 服务年期	> 3-12	>25	10 - 20	5-8

公私合作伙伴(PPP)模式

公私合作模式---非融资性质（PPP---NON Financial Base)

合作方式：

DBOM模式
(设计-建设-运营管理)

- 私营企业负责新建设施的设计、建设、运营和维护。
- 政府承担所有设施的投资 。
- 合同期内的资产属政府 。
- 一般合同期>12年，合同期满时将设施移交还给政府 。

DBOM
(Design, Build, Operate & Maintenance)

- The private sector is responsible for the new facility design, construction, operation and maintenance.
- Government's commitment to invest in all facilities
- Assets owned by Government within the contract period.
- Contract period > 12 years as usual, to transfer the facility back to the government when the contract expires.

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公私合作伙伴(PPP)模式

公私合作模式---非融资性质（PPP---NON Financial Base)

合作方式：

- 私营机构负责营运及维护：包括处理厂及所有其他服务
- 私营机构不负责任何投资
- 营运及维护合同 ~5年

托管 (DM):
(Operate & Maintenance Contract)

财务 ：优化用于为水务基建及管理提供资金的公/私营债务组合
营运 ：调整服务目标，包括客户关系、人力资源、技术方案、发展等
期内 ：暂时性、具透明度及可回复性
效率 ：政府专注法规制定，而私营机构则专注服质量

- Private sector O&M responsibility : from treatment plant only to all services
- No private investment.
- Short-term O&M contract ~5 years
  - **In financing** : optimum combination of public-private debt rations in financing water infrastructures and management
  - **In operation** : adapted service targets, including customer relations, human resources, technical solutions, development …
  - **In duration** : temporary, transparent, and reversible
  - **In efficiency** : public sector focuses on regulations, and private sector on service performance

Delegated management : O&M contract

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公私合作伙伴(PPP)模式

公私合作模式--合作（PPP---Cooperative)：

合作方式：

租赁

- 私营企业与政府协议负责对约定范围的设施执行运营管理。
- 合同期内资产由政府持有，私营者负责资产的更新维护、新增资产由政府投资。
- 服务费向终端用户收取。
- 一般合同期10-20年，合同期满时将设施移交还给政府 。

Leasing

- Private sector O&M responsibility : from treatment plant only to all services
- Major capital investment is a public responsibility and the assets remain public sector property, private sector responsible for renewals
- Direct bill the tariff charge to customers.
- Middle-term contract (10-20 years)

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公私合作伙伴(PPP)模式

公私合作模式--合资（PPP---Joint Venture)：

合作方式：

特许經营

- 私营企业通过政府授权负责对约定范围的设施执行运营管理。
- 合同期内现有资产继续由政府持有，私营者负责新增资产的投融资，设计和运营。
- 服务费向终端用户收取。
- 一般合同期>25年，合同期满时将设施移交还给政府 。

Concession

- Public authorizes the concession right to a private enterprise tor responsible all the O&M services within the service area.
- Assets remain public sector property or transferred temporarily to Project Company, private enterprise shall responsible for all O&M (customer service included) & all capital investment during the contract period.
- Direct bill the tariff charge to customers.
- Long-term contract (> 25 years)

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白银项目的PPP 方案 Baiyin PPP scheme

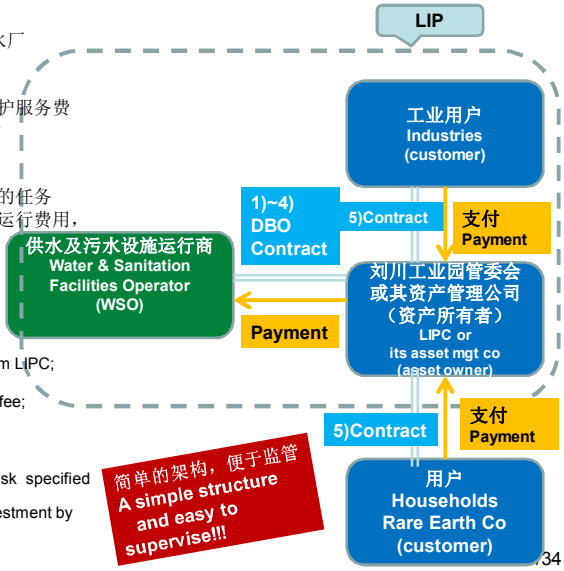
方案一：DBOM 设计-建造-运行-管理
Option 1. (DBOM)

1. 服务范围：
   1）设计&建造刘川工业园的新的供水和污水厂
   2）承包商阶段性向刘川工业园管委会请款
   3）运行维护新建水厂和污水厂
   4）运行商向刘川工业园管委会收取运行维护服务费
   5）用户向刘川工业园管委会缴纳水/污水费

2. 考虑事项
- 运行商有义务履行刘川工业园管委会制定的任务
- 刘川工业园管委会负责配套管网的投资和运行费用，以及未来新建的水厂、污水厂
- 刘川工业园管委会承担需水量风险
- 运行商无需对处理設施投资

1. Scope of services :
   1) D&B the new W/WWTP in LIP;
   2) WSO claims the progress payment from LIPC;
   3) O&M the built W/WWTP in LIP
   4) WSO charge the LIPC of O&M service fee;
   5) Customer pay the tariff to LIPC

2. Considerations：
- WSO's obligation would be taken the task specified by LIPC.
- Capex & opex on pipeworks & new investment by LIPC.
- Demand Risk on LIPC
- No investment by WSO



简单的架构，便于监管
A simple structure and easy to supervise!!!

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白银项目的PPP 方案 Baiyin PPP scheme

方案二 运行管理 Option 2. (O&M)

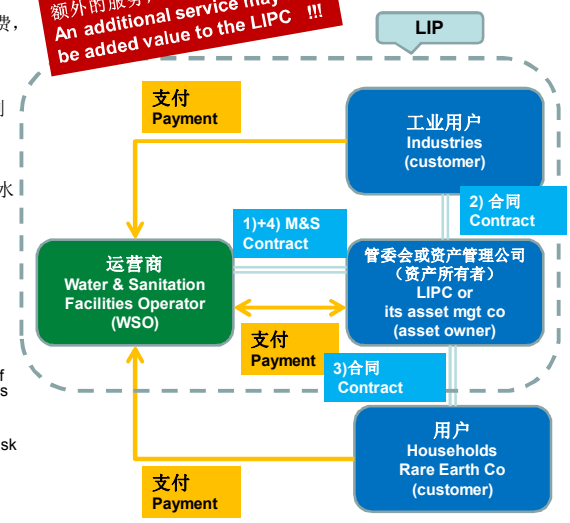
1. 服务范围
   1）运行维护园区内现有设施
   2）管委会授权运营商来向用户收取水/污水费，并存入园区的账户

2. 考虑事项
- 运行商有义务履行刘川工业园管委会制定 的任务
- 客户服务没有改善
- 刘川工业园管委会负责配套管网的投资和运行费用， 以及未来新建的水厂、污水厂
- 刘川工业园管委会承担需水量风险
- 运行商无需对处理設施投资
- 服务内容固定vs费用固定
- 额外费用 vs 额外服务

1. Scope of services:
   1) O&M existing W/WWTP in LIP;
   2) LIPC delegates WSO to collect the tariff from the customer and deposit into LIP's bank account.

2. Considerations：
- WSO's obligation would be taken the task specified by LIPC.
- No improvement in customer services.
- Capex & opex pipeworks & new investment by LIPC.
- Demand Risk on LIPC.
- No investment by WSO.
- Fixed scopes of services Vs fixed fee.
- Additional fee Vs additional services

额外的服务，对园区没有增值
An additional service may not be added value to the LIPC !!!



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白银项目的PPP 方案 Baiyin PPP scheme

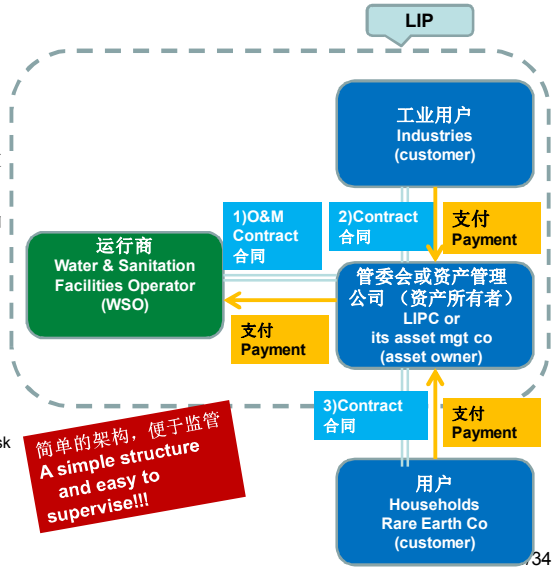
Option 3. (O&M) 方案3 运行管理

1. 服务范围：
   1）运行维护园区现有的水/污水厂
   2）用户向管委会缴费
   3）运行商向管委会收取服务费

2. 考虑事项：
- 运行商有义务履行刘川工业园管委会制定的任务
- 客户服务没有改善
- 刘川工业园管委会负责配套管网的投资和运行费用， 以及未来新建的水厂、污水
- 刘川工业园管委会承担需水量风险
- 运行商无需对处理設施投资

1. Scope of services :
   1) O&M existing W/WWTP in LIP;
   2) Customer pay the tariff to LIPC
   3) WSO charge O&M service fee to LIPC

2. Considerations：
- WSO's obligation would be taken the task specified by LIPC.
- Capex & opex on pipeworks & new investment by LIPC.
- Demand Risk on LIPC.
- No investment by WSO



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A simple structure and easy to supervise!!!

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白银项目的PPP 方案 Baiyin PPP scheme

方案4. 运行维护现有设施 + 新设施BOT
Option 4. (O&M W/WWTP+BOT on new facilities)

1. 服务范围：
   1）运行维护现有水厂/污水厂
   2）由新的BOT项目向稀土公司供水；运行商和稀土公司和未来新的园区外的用户签订合同
   3） 园区内客户向管委会缴纳水/污水费
   园区向运行商支付服务费
   4）园区外的用户向运行商缴纳水/污水费

2. 考虑事项
- 园区内用户和园区外用户的水费标准可能不一样
- 园区内的管网的投资和运行费用由园区负责
- 运行商承担部分需求风险
- 新的投资由运行商负责

1. Scope of services:
   1) O&M existing W/WWTP in LIP;
   2) WSO BOT for supply water to REC, Water supply contract sign between WSO & & Households of RDC +REC and future new customer outside LIP.
   3) Customer inside LIP pay the tariff to LIPC and LIP pay service fee to WSO.
   4) Customer outside LIP pay the tariff to WSO.
2. Consideration:
- Different tariffs may be applied on the customer outside the LIP
- Capex & opex pipework inside LIP by LIPC.
- Partial Demand risk on WSO.
- New investment by WSO

稀土公司的水和污水厂都将关闭，将来由园区统一供给和处理
W/WWTP of REC is going to be closed & to be centralized the water supply and sanitation services by LIPC !!!!

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白银项目的PPP 方案 Baiyin PPP scheme

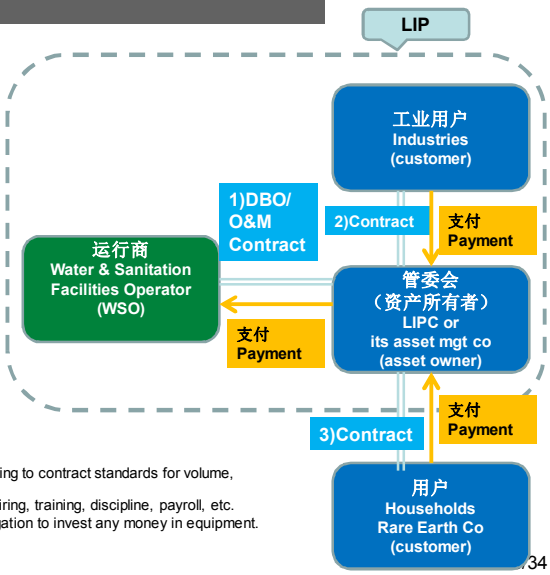
选择方案1（设计-建造-运行-维护）、方案2（运行&维护）简单 & 直接
Selected the Option 1 (DBOM, Option 2 (O&M), simple & straight forward.

商业评估：
1）简单的架构
2）界面清晰
3）权责明确

技术评估：
1）运行商根据合同要求的水量、水压、水质、服务连续性（24/7服务）提供服务
2）运行商负责所有人事事务-聘用、培训、工资等。
3）运行商负责必要的修理，但没有义务投资设备。
4）没有DBOM间隙
5）运行维护运行商需要参与调试试运行

Commercial Assessment:
1)Simple Structure;
2)Clear interfacing;
3)Clear obligation & responsibility;

Technical Assessment:
1)Operator provides water and wastewater services according to contract standards for volume, pressure, water quality, and continuity (e.g. 24/7 services)
2)Operator is responsible for all human resource issues—hiring, training, discipline, payroll, etc.
3)Operator make repairs where necessary, but has no obligation to invest any money in equipment.
4)No gap on DBOM
5)O&M operator has to participate the T&C of the plant.



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白银项目的PPP 方案 Baiyin PPP scheme

选择方案1（设计-建造-运行-维护）、方案2（运行&维护）简单 & 直接
Selected the Option 1 (DBOM, Option 2 (O&M), simple & straight forward.

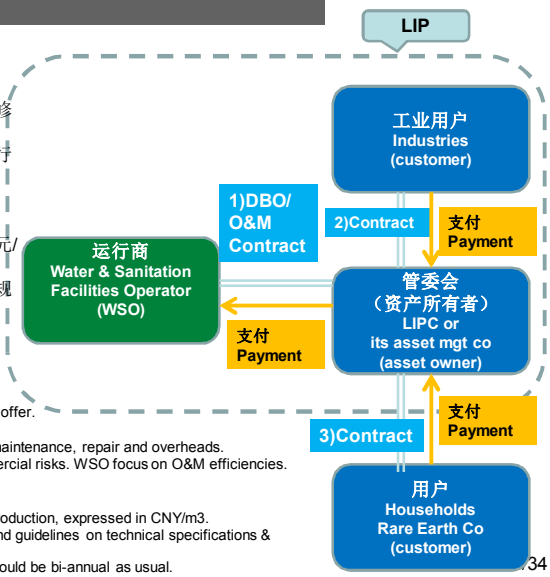
财务评估：
1）最低运行费用的运行商中标
2）管委会支付运行商协议的费用
3）费用包括：人事、能耗、药剂、一般维护、修理和管理费
4）管委会负责收费、需求和其他商业风险。运行商注重运行效率。

基本费用确定：
1）平均到单位水量的所有运行维护费用总和，元/立方米
2）运行商根据相关运行维护手册、导则、技术规范等估算，给出报价
3）根据定期的回顾调整费用，一般一年两次
4）DB和O&M风险平衡

Financial Assessment:

1) LIPC awards contract to WSO with lowest O&M fee offer.
2) WSO earns from agreed fee paid by LIPC.
3) The cost includes, HR, power, chemicals, general maintenance, repair and overheads.
4) LIPC bears all tariff collection, demand other commercial risks. WSO focus on O&M efficiencies.

Base Fee Determination
1) Calculated as summation of all unit O&M costs of production, expressed in CNY/m3.
2) WSO estimates based on relevant O&M manuals and guidelines on technical specifications & norms to arrive at best offer.
3) Fee adjustment is based on periodic review which could be bi-annual as usual.
4) Risk balance between DB & OM cost (DBOM)



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白银项目的PPP 方案 Baiyin PPP scheme

方案5 租赁 Option 5. (Lease)

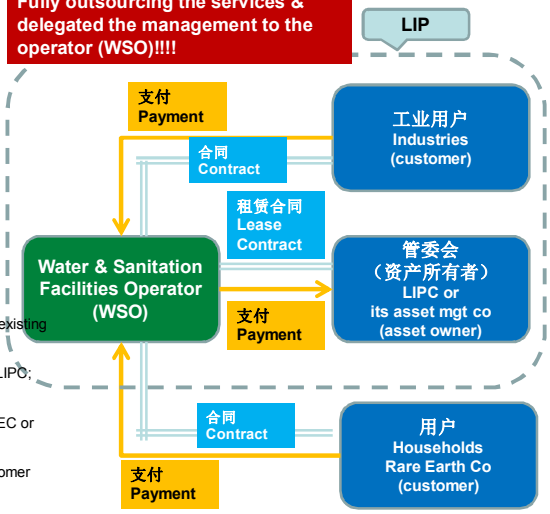
全部服务外包& 授权运行商管理
Fully outsourcing the services & delegated the management to the operator (WSO)!!!!

1. 服务范围
 1）运行商和管委会就现有设施签订租赁合同
2）运行商向管委会缴纳租金
3）运行商和管委会签订特许经营协议
4）运行商和工业用户签订供水合同
5）运行商和一般用户签订供水合同
6）所有用户向运行商缴费
运行商提供整套服务（包括客服）

2. 考虑事项
- 管委会负责新的投资
- 运行商承担需求风险
- 运行商不做投资

1. Scope of Services
 1) Lease contract sign between WSO & LIPC for existing W/WWTP
 2) WSO pay lease fee to LIPC;
 3) Concession agreement sign between WSO & LIPC;
 4) Water supply contract sign between WSO & ind.customer.
 5) Water supply contract sign between WSO & REC or new customer.
 6) All customer pay the tariff to WSO.
 7) WSO provides full water service including customer services;

2. Consideration:
- New investment by LIPC
- Demand Risk on WSO.
- No investment by WSO.



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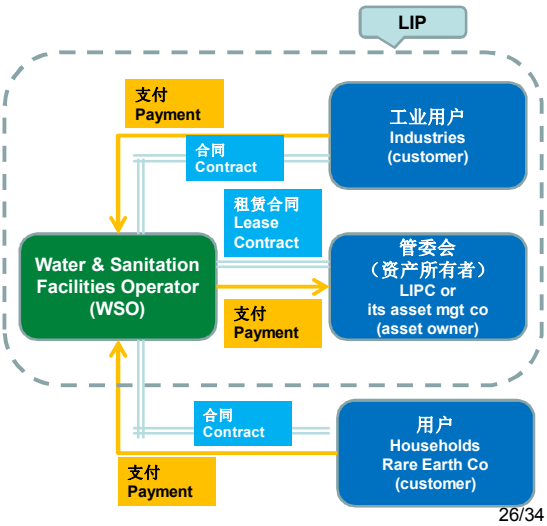
白银项目的PPP 方案 Baiyin PPP scheme

方案5 租赁 Option 5. (Lease)

商业评估：
1. 需求量/处理量预测
2. 水费和销售情况预计
3. 租赁费用
4. 有良好声誉的专业运行商很重要

Commercial Assessment:
1. Water demand/treating volume forecast.
2. Future tariffs & sales forecast.
3. Lease fee.
4. A professional operator with good reputation is important.



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白银项目的PPP 方案 Baiyin PPP scheme

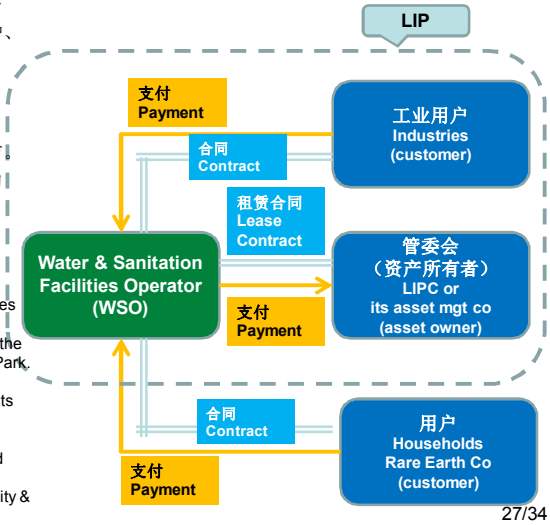
方案5 租赁 Option 5. (Lease)

技术评估：

1. 运行商负责系统的整体的运行与维护
2. 运行商提供所有的工具、材料并聘用所有需要的运行员工来保证设施的运行、维护、管理、更新。
3. 运行商负责人员、电、药剂等一切费用，包括小修理
4. 由于运行商收入和设施的运行收入挂钩，运行商需参与抄表、寄账单和收钱的环节。
5. 运行商需要承担水质和需求的变化带来的风险。

Technical Assessment:

1) Operator is responsible for complete O&M of the system
2) Operator provides all tools, materials, and supplies and employs all operations staff necessary to manage, operate, maintain, renewals and repair the water and wastewater systems of the Industrial Park.
3) The Operator pays all costs and expenses of the operations staff, electricity, chemicals and all costs and expenses including minor repairs.
4) Since the Operator is paid from revenues, the Operator is involved in meter reading, billing, and collection.
5) The Operator have to take the risk on water quality & demand variation.



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白银项目的PPP 方案 Baiyin PPP scheme

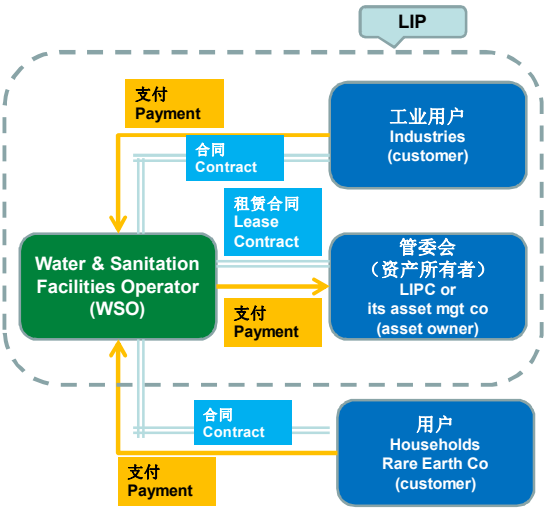
方案5 租赁 Option 5. (Lease)

财务评估：

1）管委会向运行商提供最好的租赁价格
2）合同要求运行商负责设施翻新
3）运行商从用户交纳的水费中赚钱。运行商参与调价申请。水费需覆盖所有合同义务、租金和合理的利润。
4）运行商负责收费、承担需求风险和其他商业风险

Financial Assessment:

1)LIPC awards contract to WSO with best lease price offer.
2)The contract requires WSO to finance plant renewals.
3)WSO earns from tariffs charged to customers (service user). WSO is involved in tariff application. Tariffs are cost-based and structured to cover all contractual obligations, payment of lease fee to LIPC and earn reasonable profit for WSO.
4)WSO bears all tariff collection, demand other commercial risks.



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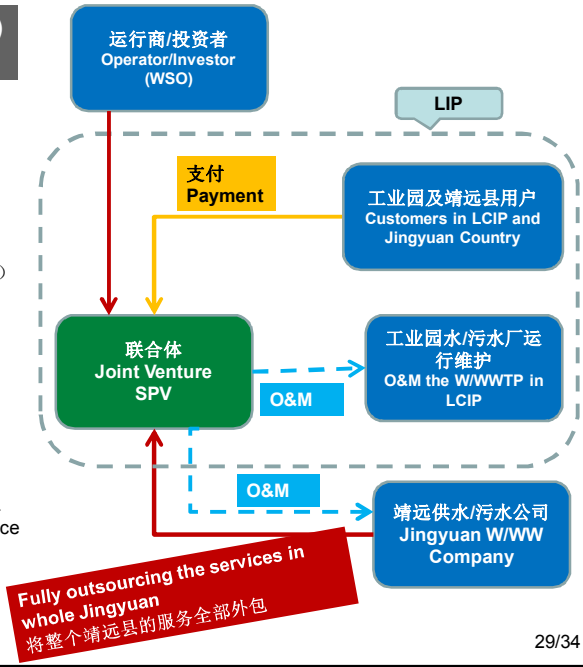
白银项目的PPP 方案 Baiyin PPP scheme

Option 6. (Full Concession) 方案6 特许经营

1. 服务范围
   1）靖远县全部的运行服务
   2） 运行商和靖远县签特许经营合同
   3）合资公司与所有用户签供水协议
   4）所有用户向合资公司缴费
   5）合资公司提供全方位服务（包括客服）

1. Scope of Services
   1) Full operational service in Jingyuan;
   2) Concession agreement sign between WSO & Jingyuan
   3) Water supply contract sign between JV & all customer.
   4) All customer pay the tariff to JV.
   5) The JV provides full water service including customer services;



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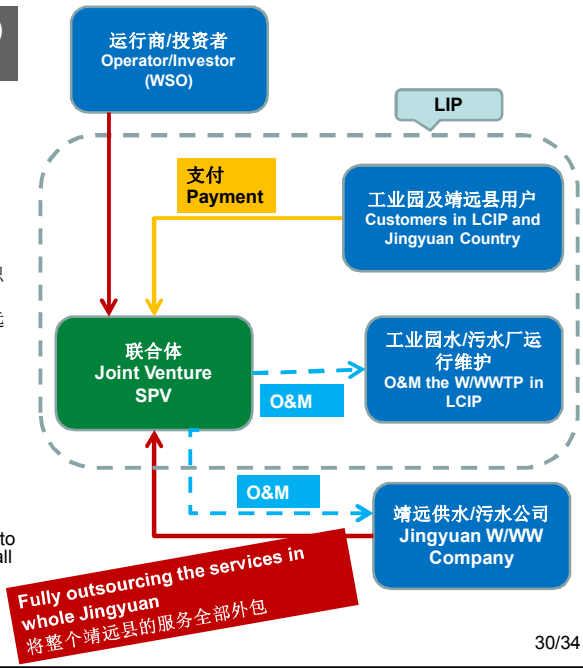
白银项目的PPP 方案 Baiyin PPP scheme

Option 6. (Full Concession) 方案6 特许经营

2. 商业评估
- 运行商承担投资风险
- 合资公司承担所有运行风险
- 需要进行资产评估
- 需要对靖远县供水/污水公司进行尽职调查
- 由所有员工、SASAC和政府批准靖远县供水/污水公司的重组

2. Commercial assessment:
- Investment risk taken by WSO
- All operational risk taken by JV
- Asset appraisal is required.
- Due dillegence on Jingyuan W/WW Company is required.
- Jingyuan W/WW company has to re-structuring and approval by all employees and SASAC as well as municipality.



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白银项目的PPP 方案　Baiyin PPP scheme

案例 一、 (TOT , Hefei Wangxiaocheng STP)

TOT 方式**收购**合肥市王小郢污水处理厂（日处理能力为30万立方米）的资产和权益，通过技术改造和优化措施提高该厂的**运营**效果和效率

TOT， 23 年运营期

4.8亿元人民币

柏林水务 – 80%； 东华工程科技股份有限公司–20%

合肥王小郢污水处理项目是中国的第一个以TOT方式实施的污水处理特许经营项目。
2004年由柏林水务和东华科技组成的联合体通过公开招投标获得了该项目23年的特许经营权。

考量:

1.刘川园区的水/污水处理尚未形成资产，且产权的变更 /转让 必须获得国资委与亚行的同意。

2.需求量/处理量预测仍然是关键因素。

Berlin Water purchased Hefei Wangxiaoying WWTP (300,000 m3/d) under a TOT contract. The performance and production efficiency was improved through technical improvements and operation optimization.

TOT, 23-year operation period
480 million CNY
Berlin Water – 80%;
East China Engineering & Technology Co. Ltd – 20%

Wangxiaoying WWTP is the first concession project of wastewater treatment under TOT contract.

In 2004, JV of Berlin Water and East China Engineering & Technology Co. Ltd was awarded the TOT contract for 23-year concession of wastewater treatment service.

Considerations:
1. The WTP / WWTP has yet to be built (not yet asset at the moment). The transition of the asset ownership should be both approved by ADB and SASAC.
2. It is essential to precast demand / treatment volume

白银项目的PPP 方案　Baiyin PPP scheme

案例 二 、 (Full Concession, SCIP)

考量:

1.白银政府需要考虑全盘资产的评估及合作的方式。

2.需求量/处理量预测仍然是关键因素。

Considerations:

1. Baiyin government should consider the overall asset assessment and cooperation method.

2. It is essential to precast demand / treatment volume.

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白银项目的PPP 方案　Baiyin PPP scheme

案例 三 、 (O&M, Haikou)

		海南省新建的17个污水处理厂	New 17 STPs of Hainan
1.	规模 Treating capacity	两个项目处理能力分别为14.1万吨/日和14.2万吨/日	141,000m3/d for 8xSTPs 142,000m3/d for 9xSTPs
2.	运营期 Duration	5年	5 years
3.	服务范围 Scopes of service	调试+运营	T&C+O&M
4.	进水标准 Influent standard	入城镇排水管网并进入污水处理厂的工业废水、医疗废水和生活污水等污废水的水质按照国家规定均达到《污水综合排放标准》（GB8978-1996）和《污水排入城市下水管道水质标准》（CJ3082-1999）的相应规定限值要求。	"Integrated Wastewater Discharge Standard" (GB8978-1996), and "sewage discharged into the urban sewer water quality standards "(CJ3082-1999) corresponding to the requirements specified limit.
5.	出水标准 Treated standard.	《城镇污水处理厂污染物排放标准》(GB18918-2002)一级B标准；	"Urban sewage treatment plant pollutant discharge standard" (GB18918-2002) a B standard;

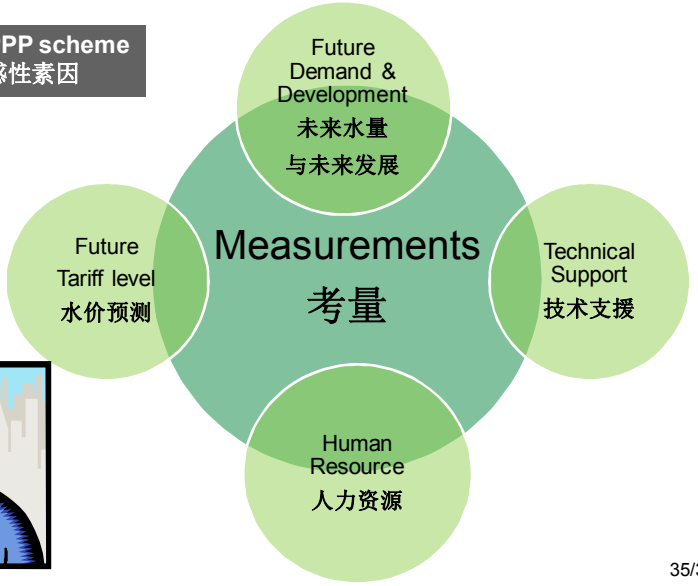
白银项目的PPP 方案　Baiyin PPP scheme

案例 三 、 (O&M, Haikou)

		海南省新建的16个污水处理厂	New 16 STPs of Hainan
6.	收费结构 Payment	起始保底水量按设计水量的65%，其后每年最少5%增加至85%封顶。	Min. 65% of treating volume in first year, at least 5% increase in progressive years, Max. 85%
7.	调价准则 Rebasing	• 包括电费、药剂费、员工工资福利费、污泥处置费、政府规费、税费； • 当污染物排放标准提高导致处理成本增加时，重新核定污水处理服务费。	•Including electricity, chemical, employee wages welfare, sludge disposal fees, administration fees, taxes; •When the discharge standards upgraded, cause the treatment costs to be increased.
8.	项目交接 Handover	• 运营商负责调试，费用由承包商及政府负责； • 当项目到期时，运营机构无偿移交项目全部资产	•The operator responsible for commissioning, the cost paid by the contractor and the government; •When the contract expires, the operators free handover of all assets

白银项目的PPP 方案
Baiyin PPP scheme

Sensitivity in PPP scheme
PPP 模式的敏感性素因



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白银项目的PPP 方案
Baiyin PPP scheme

Measurement of O&M Vs Lease 托管与租赁的考量

Commercial Measurement 商业考量	Operator (WSO) 运营商	Asset Owner (LIPC) 业主(刘川工业园)
O&M 托管	Fixed Volume定量 Fixed Fee固定收费 = Margin差额空间	Future demand & tariffs growth 未来水量及水费增长 =Margin差额空间
Lease 租赁	Upward (demand & tariffs growth) 上调(水量及水费) Downward (cost reduction) 下调(运行成本) Extension (market & customer extend) 扩展(市场及用户) =Margin差额空间	Fixed Lease fee固定租赁费 = Margin差额空间

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白银项目的PPP 方案
Baiyin PPP scheme

Measurement of O&M Vs Lease托管与租赁的考量

Technical Measurement 技术考量	Operator (WSO) 运营商	Asset Owner (LIPC) 业主(刘川工业园)
O&M 托管	Technical Requirement 技术要求 Obligation & Responsibility义务及责任 = Lower较低	Technical Risk技术风险 Technical conditions技术条件 =Lower较低
Lease 租赁	Technical Requirement技术要求 Obligation & Responsibility义务及责任 =Higher较高	Technical Risk技术风险 Technical Sensitivity技术敏感度 = Higher较高

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白银项目的PPP 方案
Baiyin PPP scheme

Measurement of O&M Vs Lease托管与租赁的考量

Financial Measurement 财务考量	Operator (WSO) 运营商	Asset Owner (LIPC) 业主(刘川工业园)
O&M 托管	New investment 新增投资 Demand Risk 用量风险 = Lower (zero)较低 (近乎零)	New Investment新增投资 Demand risk用量风险 =Higher较高
Lease 租赁	New investment 新增投资 Demand Risk 用量风险 =Higher较高	New investment 新增投资 Demand Risk 用量风险 = Lower较低

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白银项目的PPP 方案
Baiyin PPP scheme

Measurement of O&M Vs Lease托管与租赁的考量

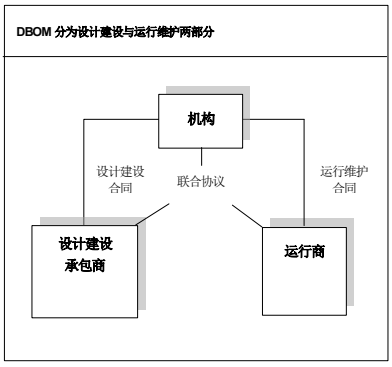
Risk Measurement 风险考虑	Operator (WSO) 运营商	Asset Owner (LIPC) 业主(刘川工业园)
O&M 托管	•Cost Overrun成本超支 •Malfunction in operation运行故障 = Lower较低	•Changes in water sources/influent quality 水源/进水水质改变 •Defects liability existing facilities现有设施潜在瑕疵 •Market Risk (demand)市场风险（需求） •Revenue(tariff collection and adjustment)收入（水费徵收及调整） =Higher较高
Lease 租赁	•Changes in water sources/influent quality水源/进水水质改变 •Market Risk (demand)市场风险（需求） •Revenue(tariff collection and adjustment)收入（水费徵收及调整） •Cost Overrun成本超支 •Malfunction in operation运行故障 =Higher较高	Defects liability existing facilities现有设施潜在瑕疵 = Lower较低

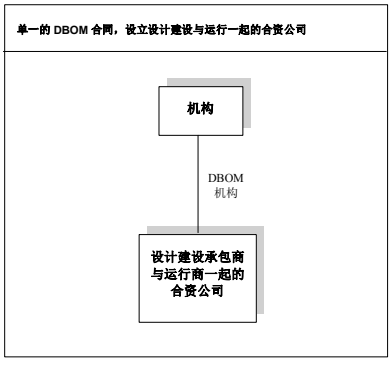
白银项目的PPP 方案
Baiyin PPP scheme

Structure 结构

Measurement of DBOM

- 不同组合方式





DBOM定义 – 联合体或者单一承包商

白银项目的PPP 方案
Baiyin PPP scheme

Different Structure 不同组合方式

Measurement of DBOM

- DBOM在工艺设计、建设工程、测试与运行雇用单一承包商；
- 减少参予层面，提高项目执行效率 ；
- DBOM联合体组合的优点是他们引入一种在运行维护方以及建设方之间建立的长期合作伙伴关系，并通过设计投入与最终产品以及资产的终生方案来体现。
- DBOM机构选择合适的结构可以促使联合体各个成员根据各自责任贡献、投入以取得成本、质量以及时效方面的效益。
- 如果设计建设合同以及运行维护合同为不同的签约方（即使有时他们都是同一方的），通常需要签定一个第三方（联合）协议来明确各方对机构所作出互相协调的承诺。(DB+OM)
- 在一些国家（澳洲、中国），已有一个贯例就是机构会与私营签约方共同聘请独立的技术鉴定机构来对建设方的工作（至少）进行审核鉴定并验証竣工、试运行以及指出质量问题。(DB+OM)

- Single contractor is responsible for the design, construction, T&C in DBOM contract
- Minimize participation interface and improve implementation efficiency
- Advantages of consortia arrangements in DBOM are that they introduce a partnering between the long term operator and maintainer and the builder which is demonstrated in design inputs and outcomes and a whole of life approach to the asset
- Appropriate structuring by the Agency can deliver an efficient outcome on Cost, Quality and Time as each member of the consortium is incentivised to contribute and input into the responsibilities of the other members
- If the parties to the D&C Contract and the O&M Contract are different (and even sometimes if they are the same), it is normal for a third (Interface) agreement to be put in place where each party promises the Agency it will co-ordinate its work with the other (DB+OM)
- In some countries (Australia, China), it has become common practice for the Agency to insist that an independent technical certifier be appointed jointly by it and the private sector parties to review and verify the elements of (at least) the builder's work and certify practical completion and commissioning, and the identification of defects (DB+OM)

白银项目的PPP 方案
Baiyin PPP scheme

Measurement of DBOM

	建设方 (Construction Contractor)	营运方 (Operator)
Risk Measurement 风险考虑	❖支付结构 ❖整体风险转移 ❖工艺设计风险 ❖工地情况风险 ❖基于绩效的试运行测试	❖运行方有长期的资产风险，因此运行方要参与设计步骤以保证整个项目目标的实现 ❖试运行也需要运行方的参与，并且测试会把运行要求考虑进去，因此才可以在试运行的移交当中接收资产。
Risks	❖ payment schedule ❖ risk transfer ❖ process design risk ❖Construction site risk ❖ performance based T&C	❖ long term asset risk is with operator and so the operator has input into the design process to ensure whole of life objectives are met ❖ commissioning involves the operator as well and its operating requirements will be factored into the testing so that it can accept the asset on commissioning handover

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白银项目的PPP 方案
Baiyin PPP scheme

Recommendation 建议

核心任务	Core Tasks
1. 保持资产及设施的完整性，结合未来的发展战略。	1. Maintain the integrity of assets and facilities, to integrate with the future planning & development strategies.
2. 搞好基礎服务和条件，创造有利招商及未来的发展的环境。	2. Improve the fundamental services and conditions, and facilitate a favorable environment for investment and future development.
3. 强化政府在公共行政管理理念和监管的角色。	3. Strengthen the government's role & the concept in public administration and regulation.

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白银项目的PPP 方案
Baiyin PPP scheme

Recommendation建议

非核心任务	Non-Core Tasks
1. 选择结构简单、市场运作的方式，通过合同约定去明确责任和义务。	1. To select a simple structure with social participating model, to clarify the responsibilities and obligations by contractual agreement.
2. 在合同期结束时，可选择收回、续签、变更业务范围或其他管理模式。	2. At the end of the contract period, it is feasible to choose either to terminate, renew, change the business model or management mode.

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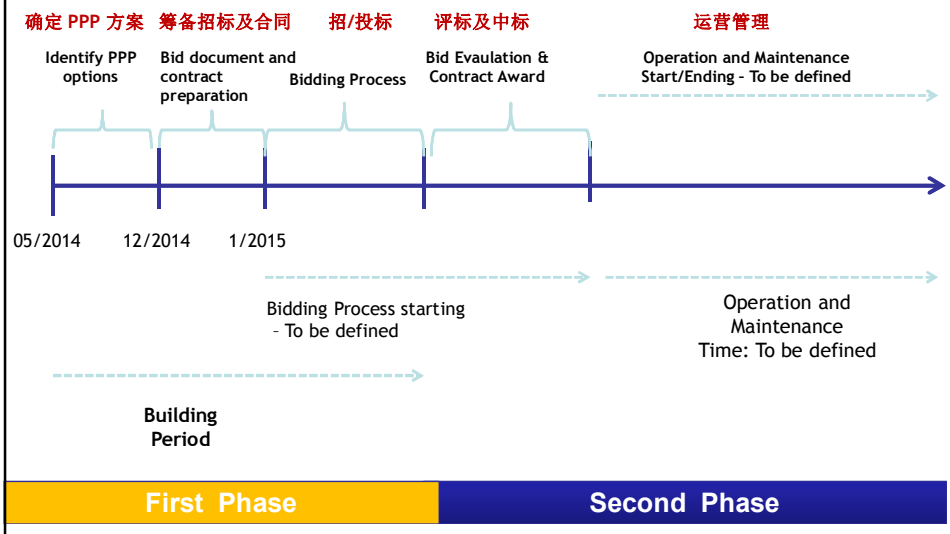
工作计划 Work Plan

计划的工作日程 Planned Mission Schedule

日期 (Date)	与会人 (Participant)	会议召开内容 (Agenda of Meeting)
DEC 2014	•ADB & BMG/LIP •PPP Team	对外公告(Market Sounding)
EXT /2015	•ADB & BMG/LIP • PPP Team	提交合同及招标文件纲要草案; (Submit Outline of Term sheet & bidding document)
EXT 2015	•ADB & BMG/LIP • PPP Team	评标及合同談判支援 (Supporting on Bid Evaluation and contract negotiation)

工作计划 Work Plan

Preliminary Program Chart - 初步程序



工作计划 Work Plan

Key elements of the Tender Documents 招标文件的主要内容

1. Scope of Services & its Requirements	1. 服务范围与要求
2. Assets Ownership	2. 资产所有权
3. Hand-Over and Acceptance of Facilities	3. 交接和设施验收
4. Influent and Effluent Water Quality	4. 进水和出水水质
5. Operations and Maintenance Proposal	5. 运营和维护方案
6. Spare Parts and Tools	6. 备件及工具
7. Laboratory Equipment	7. 实验室设备
8. Safety Program	8. 安全计划
9. Protection of the Environment	9. 保护环境
10. Operation and Maintenance Log	10. 操作和维护日志

工作计划 Work Plan

Key elements of Tender Documents 招标文件的主要内容

11. Staffing	11. 工作人员
12. Staff Training	12. 员工培训
13. Annual Operating Budget and Plan	13. 年度经营预算和计划
14. Overhaul of Major Equipment and Capital Improvements	14. 主要设备和资本改善的检修
15. Hand-back of Facilities	15. 移交的设施
• Annex 1: Service Boundary & Interfacing	附件1：服务边界与接口技术
• Annex 2: List of O&M Facilities	附件2：运行和维护的设施清单
• Annex 3: Contents of Operations and Maintenance Manuals	附件3：操作和维修手册的内容
• Annex4: Outline/Template/Model for O&M Standard Operating Procedures	附件4：操作和维修作业程序的纲要/模板/范本
• Annex 5: Reimbursable Costs	附件5：可报销费用

工作计划 Work Plan

Key Issues and Notes for the Contract合同的关键问题和注意事项

Key Issues 关键问题	Key Notes 注意事项
Facilities 设施	• the scope of work (facilities to be operated) 运营设施的工作范围 • the boundary limits within which the operator is to operate and maintain. 营运商操作和维护工作的界线范围内。
Services and Supportive Amenities 服务和支持性设施	• the design capacity of the Facilities to be operated. 运行该设施的设计能力。 • Common facilities on Site and Access Rights for THE OPERATOR's employees对于运营商的员工在公现场可使用和活动的权限 • Services from THE OPERATOR to Authority 运营商与管理当局的服务 • Supportive Amenities (such as power, raw water, disposal area) and related agreement between the Parties. 与其他支持设施（如电力，原水，弃置区）缔约方之间的相关协议
Delivery Points 交付接口	• Delivery points from Authority to THE OPERATOR such as wastewater influent or amenities delivery points, raw water intake point or delivery point.当局与运营商指定的交付点如废水进水或设施交付点、原水取水点、交接点。 • Delivery points from THE OPERATOR to Authority such as treated wastewater运营商与当局约定的交付点，如经处理的废水交接点
Minimum Guaranteed Volumes and Maximum Guaranteed Volumes 最低/最大保证水量	• Minimum guaranteed Volumes of water/wastewater to be treated: take-or-pay volume, which is generally the average daily volume待处理的水/废水最低保证量：必购必付量，一般以平均量計 • Maximum Guaranteed Volumes of water/wastewater to be treated: the design capacity of the water/wastewater treatment plant待处理的水/废水最大保证量：水/污水处理厂的设计能力

工作计划 Work Plan

Key Issues and Notes for the Contract 合同的关键问题和注意事项

Key Issues 关键问题	Key notes 注意事项
Electricity, Raw Water and Wastewater Specifications 供电，原水和废水规格	• Quality specifications of raw water/ wastewater and amenities to be delivered by Authority to THE OPERATOR at each relevant Delivery Point • 原水/废水水质和设施的规格，由管理局交付给运营商的每个相关交接点
Operating Performance Criteria 运营绩效的标准	• Services Guarantees to be provided by THE OPERATOR to Authority, in particular regarding Treated Water/Wastewater quality standard • 运营商必须向管理局提供服务保证，特别是关于处理水/废水水质标准
Operating Procedures 运行程序	• Sampling and testing regime: which quality parameter and at which frequency to be monitored and recorded at each Delivery Point • 取样和测试制度：在每一个交接点的取样和测试记录，如参数、进行监测的频率。 • Metering regime: describing how the metering is to take place at each Delivery: online monitoring and/or samples and standard protocols to be used in laboratory for quality control • 水錶：描述在每一个点的水錶状况；在线监测和/或取样、在实验室采用的质量控制校准的仪表。
Service Charges 服务收费	• Formula of Service Fee to be applied by volume according to the take-or-pay agreement. The Service Fee will cover Management Fee and Based Service Charge for fixed costs and variable costs • 将必购必付的计量用于协议的服务费计算公式。服务费将包括管理费和基本服务费为固定成本和可变成本

工作计划 Work Plan

Key Issues and Notes for the Contract合同的关键问题和注意事项

Key Issues 关键问题	Key Notes 注意事项
Price Adjustment Formula 价格调整公式	• Formula of adjustment of service fee to be applied on an annual basis. The formula will provide adjustment for costs that are not under the control of THE OPERATOR such as inflation on utilities (power, chemicals) or sludge disposal, and labour costs rules. • 每年调整服务费的计算公式。该公式将提供调整不属于经营者的控制之下，例如通货膨胀对公用事业（电力，化工）或污泥处置，以及劳动力成本的规则成本。
Liquidated Damages 违约金	• Formula of Liquidated Damages for a predefined set of circumstances, for which the Authority will be entitled to receive a compensation for a breach of services obligation by THE OPERATOR • 在预定情况对损害赔偿的计算公式，为此，当局将有权由运营商收取的违反服务及义务的赔偿
Compensation Upon Termination 终止补偿	• Formula of compensation upon early termination due to one Party to the other for predefined circumstances of termination such as THE OPERATOR or the Authority event of Default or Prolonged Force Majeure. • 在预定的情况对提前终止补偿由于任何一方的当事人终止，如违约事件由运营商或管理局或长期不可抗力。
Insurance保险	• List of Insurances and coverage to be taken by THE OPERATOR, or remaining in the scope of Authority. • 保险涵盖范围将由运营商负责，或与主局商讨。

Thank you!

谢谢！

Discussion is welcomed

欢迎大家踊跃讨论

25/11/2014

AECOM

Appendix C - Term Sheet O&M Contract

Water and Sanitation Program: TOOLKIT
Structuring Private-Sector Participation (PSP) Contracts for Small Scale Water Projects
by Victoria Rigby Delmon , May 2014

Item	Description
Parties	Authority
	Operator
	[Regulatory Agency/ other agency]
Definitions and interpretation	Set out all definitions and interpretation
	Definitions include Facilities, Project, Services, Service Area, Service Standards, Service Targets, Penalties, Applicable Law
Contract documents	List documents that form the contract and order of priority in case of inconsistency
Notices	Details of parties including address, party to receive receipt, telephone and email and specify how receipt will be proven (delivery with receipt, deemed delivery…)
Assignment	Assignment of rights and obligations under the Agreement by each party – whether this needs to be with consent of other party
	Sub-contracting – are there limitations? Is authority consent required?
Term of contract	[ ] years, renewable for up to [ ] years with serving notice of [ ] months prior to expiry [either party][authority], subject to agreement of parties
Appointment and general responsibilities of operator	Specify Service Area
	Is this exclusive or non-exclusive appointment?
	Provision of Services
	Services to be performed in accordance with the Specifications, Applicable Law, Reasonable Operating Standards
	Operator to maintain in good working condition and operate Facilities (need to specify extent of the maintenance and repair obligations of the Operator) and provide Potable Water to Customers in accordance with Service Standards, Applicable Law and Reasonable Operating Standards
	Operator to safeguard the assets
	Operator not dispose of or create liens or interests over the assets without express consent of Authority
	Open and maintain Revenue Collection Account
	Operator to employ qualified personnel
	Keep spare parts
	Consequences of failure to perform - penalties
Rights of operator	Exclusive right to provide services to customers in Service Area
	Access to the land and Facilities and third party land (to lay pipes etc)
	Right to use Facilities and assets
	Right to abstract water
	Right to Operator Fee and termination fees
	Right to provide services to customers
	Charge customers [on behalf of Authority] and enter into customer agreements
	Right to receive payments from customers
Charges to customers and collection	Operator to collect tariffs and fees in accordance with Tariff and Fee Schedule
	Operator to enter into customer agreements in agreed form
	Operator to pay tariffs into Revenue Collection Account
	Circumstances when Operator may cut off non-paying Customer, if any, and when to restore connection
	Customer complaints mechanism[may be set out in model customer agreement]
	Operator to maintain record of customer complaints
New connections	Operator to achieve [ ]% new connections by year [ ]
	Operator to provide new connection to every potential customer making written application for such connection, subject to overall capacity of the Facilities
Records, accounts and reports	Operator to keep proper and adequate records of performance and incidents

Appendix C - Term Sheet O&M Contract

Water and Sanitation Program: TOOLKIT
Structuring Private-Sector Participation (PSP) Contracts for Small Scale Water Projects
by Victoria Rigby Delmon , May 2014

Item	Description
	Operator to keep accounts [Monthly], quarterly, six monthly annual and send them to authority
	Do any of the reports and accounts need to be audited?
	Does authority have right of review/ audit? If so, what is time frame? If there is a dispute, consider using an independent auditor to settle dispute over accounts
Business plans	Operator to prepare and submit business plans within [ ] months of commencement date to cover [5] years
	Business plan to be update periodically [annually]
	To be reviewed by Authority
	Business plan to include:
	Operations – overall strategies, services to be provided and standards and targets, performance indicators, necessary investments, plans for expansion (if any) and strategy for new connections
	Finance – financial targets, financial strategies (including tariffs, fees, charges), forecast revenue
Asset register	Operator obligation to prepare/ update an asset register within [ ] months of commencement date and keep up to date and to hand over on expiration or termination
Operating manuals	Operator to prepare operating manuals within [ ] months of commencement date, to keep up to date and to handover on expiration or termination
Allow inspection of land, assets, records and documents	Allow inspection by authority (and regulatory agency), access to facilities, to take tests, make copies of documents
Employees	Requirement to employ staff with relevant experience and qualifications.
	Duty to provide statutory remuneration and benefits as minimum, and any follow other statutory requirements regarding staff
	What happens to staff at end of agreement
Indemnification	No liability of either party for damage to persons or property of other party arising other than out of the negligence or willful default of that party
Limitation of liability	Liability for environmental pollution etc – is there a limitation
	General limitation of liability if any
Owner's Duties	Monitor performance of Operator
	Review/ audit accounts and review reports and records
	Approve business plan
	Not to interfere with operations
	Carry out environmental impact assessment [if there is to be construction]
Force majeure	Events
	Consequences
	Extended force majeure – early termination
Early termination	For cause – operator default, authority default, termination at will, termination for extended force majeure
	Notice and cure periods for default
	Consequences of termination – termination fees
Handover on expiry or termination of agreement	Handover of Facilities, spare parts and assets, operations manual, asset register, royalty free license to use software and other IP for the purposes of delivering the Service and operating the Facilities
	Employees (any to be transferred to authority?)
Dispute resolution	Mutual agreement, conciliation or expert determination (could be local branch of regulatory agency), arbitration or courts
Miscellaneous	Operator duty to keep insurance – for third party liability, employees assets
	Governing law
	Language
	Confidentiality

Appendix C - Term Sheet O&M Contract

Water and Sanitation Program: TOOLKIT
Structuring Private-Sector Participation (PSP) Contracts for Small Scale Water Projects
by Victoria Rigby Delmon , May 2014

Item	Description
	Variations/ amendments of agreement
	Severability of contract provisions in case a clause is invalid
	Authorized representative
	Survival of specific clauses after termination and expiration
	Conflict of interest
Schedule – service area	Service Area map
Schedule - Facilities	Describe main equipment that constitutes the Facilities to be used for the Service
Schedule – Performance specifications and minimum service levels	Availability of supply
	Service coverage
	Quality of treated water
	Water pressure
	Continuity of service
	Maintenance and repairs
	Prevention of pollution
	Non-revenue water
	Percentage of billing enquiries in a period
Schedule – performance targets – service levels	Could include Connections
	Non-revenue water
	Availability of supply
Schedule – Penalties [and bonuses]	Consequence of failure to meet service standards and targets – plus maximum penalties to be charged in one period
	Any bonuses for outperformance?
	Tariffs
	Initial tariffs and tariff review methodology - is there regulatory approval required
	Periodic reviews – how often? Is there an appeal process if authority to approve
Schedule – operator fees	Operator Fees, how to invoice, when paid, interest to be charged for late payment of authority and mechanisms for adjustment of fee
Schedule – termination payments	Termination for cause
	Operator
	Authority
	Termination at will
	Termination for extended force majeure

Appendix D - Term Sheet DBO Contract

There are two options for DBO contract:
(1) a standard civil works contract and an operation and maintenance contract
(2) one combined contract
If option #1 is used, then make sure the two documents are consistent and have an overarching agreement that specifies priority in case of inconsistency.

World Bank Water and Sanitation Program: Toolkit Structuring Private-Sector Participation (PSP) Contracts for Small Scale Water Projects, May 2014
Victoria Rigby Delmon

Item	Description
Parties	Authority
	Operator
	[Regulatory Agency/other agency]
Definitions and interpretation	Set out all definitions and interpretation
	Definitions include Existing Facilities, New Facilities, Project, Services, Service Area, Service Standards, Service Targets, Penalties, Applicable Law, Construction Period, Operations Period
Contract documents	List documents that form the contract and order of priority in case of inconsistency
Notices	Details of parties including address, party to receive receipt, telephone and email and specify how receipt will be proven (delivery with receipt, deemed delivery…)
Assignment	Assignment of rights and obligations under the Agreement by each party – whether this needs to be with consent of other party
	Sub-contracting – are there limitations? Is authority consent required?
Term of contract	[ ] years, or construction period + [ ] years, renewable for up to [ ] years with serving notice of [ ] months prior to expiry [either party][authority], subject to agreement of parties
Appointment and general responsibilities of operator	Specify Service Area
	Is this exclusive or non-exclusive appointment?
	Provision of Services – design and build (see below) + plus operations. Will this include some repairs of larger parts, renewal?
	Services to be performed in accordance with the Specifications, Applicable Law, Reasonable Operating Standards
	Operator to maintain in good working condition and operate Facilities (need to specify extent of the maintenance and repair obligations of the Operator during operations period) and provide Potable Water to Customers in accordance with Service Standards, Applicable Law and Reasonable Operating Standards
	Operator to safeguard the assets
	Operator not dispose of or create liens or interests over the assets without express consent of Authority
	Open and maintain Revenue Collection Account
	Operator to employ qualified personnel
	Keep spare parts
	Carry out specific renewals if there is a renewals schedule
	Consequences of failure to perform – penalties
Rights of operator	Exclusive right to provide services to customers in Service Area
	Access to the land and Facilities and third party land (to lay pipes etc)
	Right to use Facilities and assets
	Right to abstract water
	Right to Operator Fee and termination fees
	Right to provide services to customers
	Charge customers [on behalf of Authority] and enter into customer agreements
	Right to receive payments from customers
Design and build obligations	Operator to design and build the New Facilities in accordance with the Specifications, Applicable Law and Reasonable Operating Standards and within the time for completion
	Is there a requirement to refurbish Existing Facilities?
	Is the construction fee to be paid in instalments following testing commissioning of sections of the new facilities or at the end of construction, testing and commissioning?
	Liquidated damages for delay
	Testing and commissioning – how and when is performance certificate issued
	Is the authority to monitor construction or a third party such as an engineer?
	Operator to prepare as – build drawings of new facilities
	Operator to prepare monthly progress reports and submit these to the authority [and the engineer]

Item	Description
Charges to customers and collection	Operator to collect tariffs and fees in accordance with Tariff and Fee Schedule
	Operator to enter into customer agreements in agreed form
	Operator to pay tariffs into Revenue Collection Account
	Circumstances when Operator may cut off non-paying Customer, if any, and when to restore connection
	Customer complaints mechanism[may be set out in model customer agreement]
	Operator to maintain record of customer complaints
New connections	Operator to achieve [ ]% new connections by year [ ]
	Operator to provide new connection to every potential customer making written application for such connection, subject to overall capacity of the Facilities
Records, accounts and reports	Operator to keep proper and adequate records of performance and incidents
	Operator to keep accounts [Monthly], quarterly, six monthly annual and send them to authority
	Do any of the reports and accounts need to be audited?
	Does authority have right of review/audit? If so, what is time frame? If there is a dispute, consider using an independent auditor to settle dispute over accounts
Business plans	Operator to prepare and submit business plans within [ ] months of commencement date to cover [5] years
	Business plan to be update periodically [annually]
	To be reviewed by Authority
	Business plan to include:
	Operations – overall strategies, services to be provided and standards and targets, performance indicators, necessary investments, plans for expansion (if any) and strategy for new connections
	Finance – financial targets, financial strategies (including tariffs, fees, charges), forecast revenue
Asset register	Operator obligation to prepare/update an asset register within [ ] months of commencement date and keep up to date (to take into account new facilities) and to hand over on expiration or termination
Operating manuals	Operator to prepare operating manuals within [ ] months of commencement date, to keep up to date and to handover on expiration or termination
Allow inspection of land, assets, records and documents	Allow inspection by authority (and regulatory agency), access to facilities, to take tests, make copies of documents
Employees	Requirement to employ staff with relevant experience and qualifications.
	Duty to provide statutory remuneration and benefits as minimum, and any follow other statutory requirements regarding staff
	What happens to staff at end of agreement
Indemnification	No liability of either party for damage to persons or property of other party arising other than out of the negligence or wilful default of that party
Limitation of liability	Liability for environmental pollution etc – is there a limitation
	General limitation of liability if any
Duties and rights of authority	Provide (lease over) facilities and land, obtain abstraction permit
	Grant [exclusive] right to provide services to customers in Service Area
	Set tariffs [with regulatory agency authority] in accordance with tariff methodology set out in Agreement and periodic reviews as specified in the Agreement
	Pay operator fee
	Pay capital contribution [or carry out certain repairs and renewals as set out in schedule]
	Monitor performance of Operator
	Review/audit accounts and review reports and records
	Approve business plan
	Not to interfere with operations
	Carry out environmental impact assessment [if there is to be construction]
Force majeure	Events
	Consequences
	Extended force majeure – early termination

Item	Description
Early termination	For cause – operator default, authority default, termination at will, termination for extended force majeure
	Notice and cure periods for default
	Consequences of termination – termination fees
Handover on expiry or termination of agreement	Handover of Facilities in good working condition (wear and tear excepted), spare parts and assets, operations manual, asset register, royalty free license to use software and other IP for the purposes of delivering the Service and operating the Facilities. Should there be specific parts replaced within a specified period prior to expiry?
	Employees (any to be transferred to authority?)
Dispute resolution	Mutual agreement, conciliation or expert determination (could be local branch of regulatory agency), arbitration or courts
Miscellaneous	Operator duty to keep insurance—for third party liability, employees assets
	Governing law
	Language
	Confidentiality
	Variations/amendments of agreement
	Severability of contract provisions in case a clause is invalid
	Authorized representative
	Survival of specific clauses after termination and expiration
	Conflict of interest
Schedule – Service Area	Service Area map
Scheule - Existing Facilities	Describe the main existing assets that the authority is to provide to the operator at the beginning of the contract
Schedule – New Facilities	Specifications
	Time for completion
	Liquidated damaged for delay in completion
Schedule – Performance specifications and minimum service levels	Availability of supply
	Service coverage
	Quality of treated water
	Water pressure
	Continuity of service
	Maintenance and repairs
	Prevention of pollution
	Non-revenue water
	Percentage of billing enquiries in a period
Schedule – performance targets – service levels	Could include Connections
	Non-revenue water
	Availability of supply
Schedule – Penalties [and bonuses]	Consequence of failure to meet service standards and targets – plus maximum penalties to be charged in one period
	Any bonuses for outperformance/early completion of construction?
Tariffs	Initial tariffs and tariff review methodology – is there regulatory approval required
	Periodic reviews – how often? Is there an appeal process if authority to approve?
Schedule – operator fees	Operator Fees, how to invoice, when paid, interest to be charged for late payment of authority Typically for a DBO these will include:
	Payments in instalments/lump sum on issue of Performance Certificate for New Facilities
	Operating Fee (may be fixed to cover fixed costs + variable to cover consumables) and mechanism for adjustment of fees
Schedule – termination payments	Termination for cause
	Operator
	Authority
	Termination at will
	Termination for extended force majeure

SUPPLEMENTARY DOCUMENT 7
CAPACITY DEVELOPMENT ACTIVITIES CONDUCTED IN PPTA

Date	Contents of activities	Venue	Participants	Presentation in this file
2 December 2013	ADB's emphases in PPTA	Wansheng Hotel, Baiyin	Gansu Provincial DRC and Finance Bureau, BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 A
20 January 2014	Environmental training	Wansheng Hotel, Baiyin	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 B
20 January 2014	Resettlement training	Wansheng Hotel, Baiyin	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 C
20 January 2014	Procurement training	Wansheng Hotel, Baiyin	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 D
20 January 2014	Disbursements training	Wansheng Hotel, Baiyin	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 E
20 January 2014	PPMS and DMF training	Wansheng Hotel, Baiyin	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 F
20 January 2014	Reclaimed water reuse training	Wansheng Hotel, Baiyin	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 G
27 May 2014	Industrial sector assessment	Baiyin DRC Conference Room	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 H
27 May 2014	PPP	Baiyin DRC Conference Room	BMG, Baiyin municipal authorities, Baiyin PMO, Jingyuan county authorities, local design institutes	SD 7 I

• Inclusive development (1) Project must not only benefit local economic development as whole, but also benefit poor specifically. (2) E.g. coverage of those fringe areas & villages currently without good infrastructure coverage • Issues reflected in consultation of all stakeholders have to match project benefits in DMF. For each component there must be description of existing situation; for each component benefits must be quantified.	• 包容性发展 (1) 项目效益不仅看地方整体经济发展，更要叫最贫困阶层受惠 (2) 例如，覆盖目前没有良好基础设施覆盖的边缘群体、村庄 • 从咨询所有利益相关方中所反映的问题，与设计与检测框架的项目效益要联系上，每一个子项目都要有现状描绘，每一个子项目的效益都要量化

近年来亚行对中国贷款的项目准备技术援助较强调的要求

Requirements usually emphasized in ADB PPTAs for PRC loans in recent years

• Excessive construction has to be avoided. Demand, by which scale of project is supported, cannot be based simply on local planning (generally regarded as exaggerated), but needs to be supported by current status & past historical trends, or more macro, objective factors. • More extreme weather caused by climate change – especially temperature rise, more frequent & more serious flooding, more frequent & more serious drought etc.: 1. Mitigation – Benefits of energy conservation & emission reduction have to be quantified. 2. Adaptation – Project design & management need to consider responses to risks of extreme weather.	• 避免过度建设，项目规模所依据的需求量不能仅仅按当地规划（一般视为比较夸大）执行，需有现状情况、过去历史趋势等作为支撑，或有较宏观的客观环境因素 • 气候变化所导致的更极端的天气－特别指温度提升、更多更严重的洪涝、更多更严重的干旱等 1. 缓解-要量化节能减排效益 2. 应对-项目设计和管理需考虑应对极端天气风险的影响

• Since 2008 until now, these requirements are increasing year by year. • ADB's objective is to help developing countries in Asia reduce poverty & backwardness. Among developing countries in Asia, PRC is considered to be not too poor & to have relatively strong technical capability. Therefore, ADB's loans to PRC require additional substantiation if they are to be approved.	• 2008年一直到现在，要求逐年递增 • 亚行宗旨在于帮助亚洲的开发中国家减除贫穷落后，而在亚洲的开发中国家之中，中国被视为不太贫穷，技术能力较强，所以，亚行对中国的贷款需要有其他支撑才能通过

• Water balance – Allocation of water resources must be adequate considering use of every sector in upstream & downstream. • Overall consideration of water system – Wastewater & water supply systems have to match each other. • Wastewater treatment has to consider sludge disposal & wastewater reuse. • Water demand management – Reduction of NRW • Ensure that project complies with all local & specialist plans • Safeguards requirements from 2009 – Related to environment, resettlement, & ethnic minorities; in particular, public participation & consultation is required, & detail grievance redress mechanism has to be set up	• 水平衡-水资源的分配要足够，考虑上下游、各个行业的用途 • 整个水系统的考虑-污水与给水系统匹配 • 污水处理要考虑污泥处置和中水回用 • 需水管理-减少无收益水 • 确保项目要符合各地方、各行业的规划 • 2009年的安全保障要求-针对环境、移民安置、少数民族，特别要有公众参与和咨询，并且设立详细的申诉处理机制

Substantiation for projects has to include • Improvement on environmental pollution (Pollution of environment in PRC, including air & water, pollution, is very serious.) • Improvement of "soft" environment (including management methods, mechanisms, PPP etc.) • Innovation that has demonstration effect on other projects in other places • Reduction of urban-rural gap • TVET etc.	项目的必要性要包括 • 环境污染的改善（中国的环境－包括空气和水体－污染相当严重） • 「软性的」环境（包括管理模式、制度、公私营参与等等）的改善 • 创新性，而在一个项目的创新能对其他地方起示范作用 • 缩减城乡差距 • 职业教育等等

主要内容 Overview

1. ADB Safeguard Policy
   亚行保障政策
2. Management Procedures
   亚行贷款项目环境管理的程序
3. 工业园环境管理 Environmental Management in IP

ADB AECOM

• New format of RRP in started in 2010, in particular including PAM • PAM includes various arrangements in loan implementation process, e.g. implementation plan, project management arrangements, flow of funds, performance monitoring & evaluation, loan covenants, & detail resettlement schedule • Loan covenants – Include assurances required, e.g. that construction & O&M of associated projects (such as road connections, utility connections including branch pipes & household connection pipes) should be synchronized; personnel & budget of O&M; raising of water tariffs	• 2010年开始的新行长报告和建议格式，尤其是项目行政手册 (PAM) • PAM包括对贷款实施过程的各样安排：如实施计划、项目管理安排、资金流，绩效监测和评估，约定的条款，移民安置具体时间表等等 • 贷款约定条款-包括所需的承诺，如相关项目（如连接的道路、连接的管线包括支管和入户管）的建设、运营要同步，运营养护的人员和预算，水费的提升

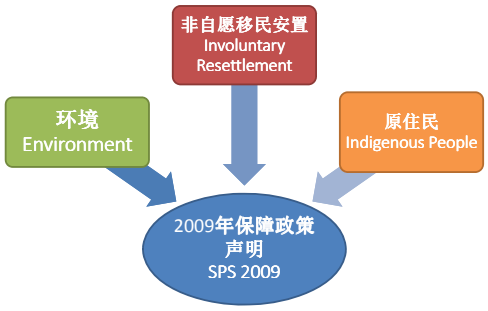
第一部分 PART 1

亚行保障政策 ADB'S SAFEGUARD POLICY

ADB AECOM

SDAP & GAP – need to be consulted with each stakeholder, & have to specify who are to implement what, sources of finance, what indicators have to be met, & when to complete	社会发展行动计划、性别行动计划-需要与各相关方协商好，要落实到谁执行，经济的来源，要达到什么指标，完成的时间

1. 亚行保障政策ADB'S SAFEGUARD POLICY



亚行环境保障政策与亚行贷款项目环境管理要求

ADB's Environmental Safeguard Policy and Environmental Management Requirements

2014年1月20日

袁婧薇 Yuan Jingwei

2. 环境管理程序

项目准备阶段

- 对所有拟定的项目进入梳理程序，确定环境评价范围和类型
- 对每个拟定项目进行环境评价
- 形成行长建议书和贷款协议的环境保障条款

项目的执行与监督

- 实施环境管理计划并监测其实施效果

项目竣工及后评估

- 审查实际环境影响和环境管理计划实施效果

环境保障 Environment Safeguard

保障政策目标	• 避免项目对环境和受影响人群的 • 对不可避免的负面影响、尽量减轻和缓解不利影响，并/或提供补偿 • 帮助强化贷款人的保障制度，及发展应对环境和社会风险的能力
环境保障政策目标	• 保证项目的环境安全和可持续性，在决策过程中综合考虑环境问题
政策范围和启动条件	• 如果项目存在潜在的环境风险和影响，则需要启动环境保障政策

亚行不资助不遵守《保障政策声明》的项目，也不资助不遵守项目所在国的社会环境法律的项目

2. 环境管理程序

贷款方 Borrower	亚行 ADB	技援小组 PPTA
• 进行国内环境影响评价 • 对受影响人群和社区进行咨询 • 落实国内环评报告书能满足国内要求 • 编制和实施环境管理计划 • 监测环境管理计划的执行 • 编制和提交监测报告	• 向贷款方解释保障政策的要求 • 通过能力建设帮助贷款方在项目准备和实施过程中满足这些要求 • 进行尽职调查 • 审查和监督执行情况	• 审阅贷款方的环评报告书 • 与环评单位协调在达到亚行要求的前提下，补充资料的提供 • 根据环评报告书和补充资料、代表贷款方编制及提交给亚行审查的《环境影响评价》报告

第二部分 PART 2

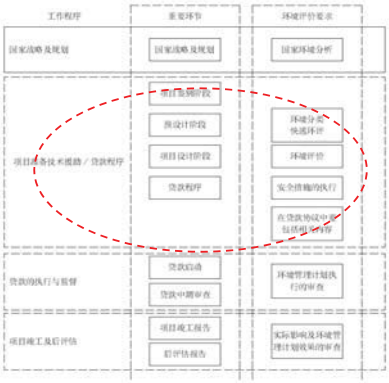
环境管理程序
ENVIRONMENTAL MANAGEMENT PROCEDURES

2. 环境管理程序

2.1 项目准备阶段：亚行的环境影响分类

环境分类	特点	环境评价基本要求
A类	如果项目可能对人口、生物多样性或自然资源产生重大不利影响，而且影响不可逆、多变或者前所未见，那么该项目就是A类项目。	A类项目的环境影响可能会超出项目施工地点。需要进行环境影响评价。
B类	B类项目环境负面影响小于A类项目。这些影响局限于具体项目地点；很少是不可逆的；在大多数情况下，减缓措施的制定要比A类项目容易很多。	需要环境审查，编制初步环境评估报告
C类	C类项目对环境影响很小或者没有负面影响。	筛选审查之后，不需要做进一步的环评工作，但是评估结果要反映在行长建议书中，并制定简要的环境管理计划。
FI类	金融中介机构项目就是通过金融中介机构融资的亚行项目。需要建立相应的环境和社会管理系统。当金融中介机构项目没有社会和环境负面影响或影响很小时，可以被当作C类项目。	没有特别要求。

2. 环境管理程序



2. 环境管理程序

2.1 项目准备阶段：
环评中常见的问题-累积影响

2. 环境管理程序

2.1项目准备阶段：环境影响评价

环境影响评价报告

- 摘要 Executive summary
- 政策、法律和管理框架 Policy, legal & administrative framework
- 项目说明 Project description
- 环境描述[现状调查] Existing baseline
- 环境影响和减缓措施 Environmental impact & mitigation
- 方案比选分析 Analysis of alternatives
- 信息公开和公众参与 Information disclosure & public consultation
- 环境管理计划 Environmental management plan
- 申诉机制 Grievance redress mechanism
- 结论和建议 Conclusion & recommendation

2. 环境管理程序

公众参与/信息公开

- 与受影响人群进行有效协商，并帮助他们在充分了解情况后参与到项目中。
- 保证妇女参与协商的权利。
- 在项目的早期准备阶段就应有利益相关方的参与，包括受影响的人群和有关的非政府组织，并保证他们的观点和诉求能被有效传递至决策者，作为其决策依据。在项目实施全过程中应不断和利益相关方协商，以处理与环境评价有关的问题。
- 建立申诉机制，以便了解和解决受影响人群对项目的环境影响的关注和投诉。

2. 环境管理程序

2.1 项目准备阶段：环评中常见的问题

环境敏感点	现状调查	生物资源	物质文化资源	方案分析/比选	关连项目
• 代表性 • 离项目地的距离 • 受影响的住户和人口数目	• 数据的真实性 • 数据的代表性 • 可用近期文献资料补充	• 稀有或濒危物种 • 受保护地区 • 如没有，需说明没有	• 文物古迹或文化遗产 • 有历史，考古，古生物学或建筑价值的物体或地点 • 如没有，需说明没有	• 零项目方案 • 分析环境效益和影响 • 达到挑选最终方案的理据	• 污水管道/污水厂 • 污水厂/污泥处理 • 垃圾收集/垃圾处理

环境管理程序

公众参与/信息公开

在PPTA阶段两次 Twice during PPTA stage	建议用座谈会的形式 Suggest in form of public forum	第一次在环评刚开始时进行项目简介和收集意见和建议 First time at EIA commencement to collect views and suggestions
第二次在环评初稿完成后提供环评结论和环保措施，并收集意见和建议 Second time after draft EIA preparation to present findings and measures	选择有代表性的对象，包括政府代表,非政府代表和受影响居民 Select representative participants	亚行信息公开：报告上网120天 ADB information disclosure: EIA posting for 120 days on web site

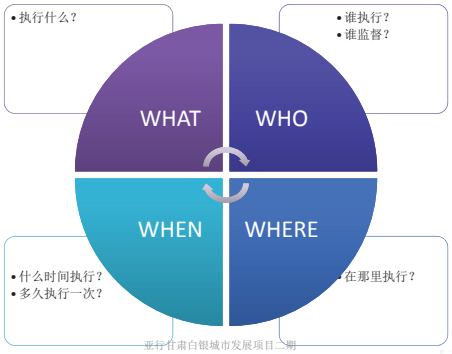
2. 环境管理程序

2.1 项目准备阶段：环评重点

道路工程	管道工程	污水处理	给水工程
• 代表性 • 离项目地的距离 • 扬尘 • 噪声 • 土方量 • 弃土回用 • 弃土堆填地点	• 土方量 • 弃土回用 • 弃土堆填地点	• 生活与工业废水处理的整体规划 • 水体污染现状 • 排水对水体的影响 • 减废量	• 给水的整体规划 • 水源质量现状 • 水源地保护 • 对地下水的影响

2. 环境管理程序

环境管理计划的“4W”



2. 环境管理程序

2.1 项目准备阶段： 公众参与讨论会

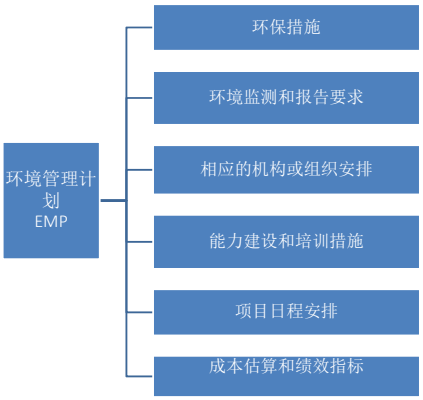

辽源


禾木


伊宁

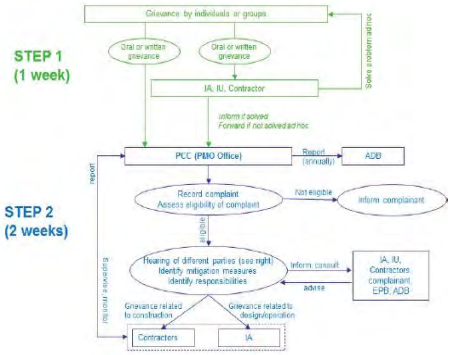

靖远刘川工业园

环境管理程序



2. 环境管理程序

申诉机制 GRM



2. 环境管理程序

环境管理计划的成本估算

包含

- 监测费用
- 施工期临时环保措施
  - 洒水车
  - 沉淀池、沉淀药
  - 临时隔声屏
- 公众参与费用
- 培训费用

不包含

- 已包含在建设费/营运费的永久设施，如
  - 污水厂除臭设施
  - 泵房隔声设施
- 已包含在设计和招标费用的工作

2. 环境管理程序

环境管理计划

3. 工业园环境管理

2. 环境管理程序

2.2 项目执行阶段

中方	亚行
• 中国的执行机构将具有项目实施的主导权，负责项目过程的各项工作并定期向亚行通报项目进展情况。 • 在此阶段环境管理相关工作为：“三同时”管理、施工现场环境监理、环保设施试运行、环境影响监测。	⑩行将对项目全程监管，派出项目启动团检查项目建设准备情况并具体细化贷款文件，报告环境监测和水土流失监测，形成项目管理备忘录。 • 每年至少派一次检查团检查项目进展情况，特殊情况还会派出特别检查团。 • 在此阶段环境管理相关工作为：修订环境管理计划、对环境管理计划的实施进行审查。

3. 工业园环境管理

基础设施生态化发展
Eco-Industrial Park Infrastructure Construction

能源一体化
Energy Integration

2. 环境管理程序

2.3 项目验收和后评估阶段

中方	亚行
• 验收：建设项目的环境保护竣工验收、建立项目环境管理相关制度；环境保护竣工验收报告；项目完工报告》（贷款项目完工6个月内）交亚行运行评估局审阅 • 后评估：例行环境监测、污染物排污申报登记	• 验收：进行完工后的检查，编制《项目完工报告》对贷款项目进行全面总结 • 后评估：编制《项目绩效评估报告》，完工后2—3年——依照REESI进行检查（相关性、效果、效率、可持续性和机构发展）

3. 工业园环境管理

生态工业园区基础设施建设
Eco-Industrial Park Infrastructure Construction

污水处理、再利用和循环
Waste water treatment，reuse and recycle

3. 工业园环境管理

1. 《关于加快推行清洁生产的意见》
2. 《国务院关于加快发展循环经济的若干意见》（国发〔2005〕22号，以下简称《意见》）
3. 《国家生态工业示范园区管理办法（试行）》[2007](18))
4. 《行业类生态工业园区标准（试行）》（HJ/T 273-2006）
   《综合类生态工业园区标准（试行）》（HJ/T 274-2006）
   《静脉产业类生态工业园区标准（试行）》（HJ/T 275-2006）

3. 工业园环境管理

生态园区建设政策支持
Supportive policies for Eco-Industrial Park

出台了一整套鼓励节能降耗、生态环保、发展循环经济的政策支撑体系。

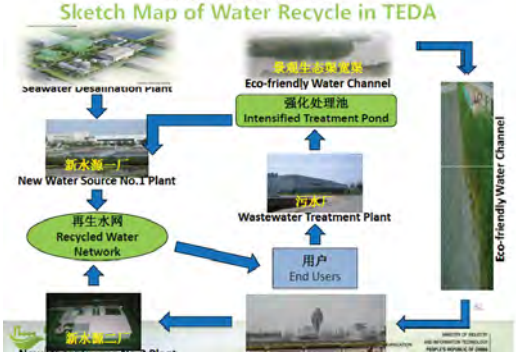
A series of supportive policies have been promulgated to encourage energy conservation and consumption reduction, eco-friendliness and environmental protection, and the development of circular economy.

一亿元节能环保补贴资金
0.1 billion Energy conservation and Environment protection subsidies

天津经济技术开发区节能降耗、环境保护重点鼓励项目名录（第四批）
TEDA Energy conservation and Environment protection Encourage list（4th Version）

3. 工业园环境管理

水循环利用示意图
Sketch Map of Water Recycle in TEDA



3. 工业园环境管理

建立低碳发展促进平台
Established low-carbon development promotion platform

天津滨海新区 TIANJIN BINHAI NEW AREA
TEDA 天津经济技术开发区-泰达

资助方 Sponsor	泰达管委会 TEDA Administrative Committee
成立时间 Date of Establishment	2010年3月23日 23rd ,March, 2010
非营利组织 Non-Profit Organization	

3. 工业园环境管理

3. 工业园环境管理

3. 工业园环境管理

产业生态化发展
Industrial ecological development

企业层面
For Enterprise

240 家企业通过ISO14001
240 companies has passed ISO14001


ISO14001 training

70家企业开展了清洁生产审计
70 companies has implemented Clean Production Auditing


Clean Production auditing training

亚行的保障政策
—务必遵从的政策
ADB Safeguard Policies
- compliance is mandatory

- 非自愿移民 – 1995
- 土著居民 – 1998
- 环境评价 – 2002
- 保障政策声明–2009

- Involuntary Resettlement (IR) - 1995
- Indigenous Peoples (IP) - 1998
- Environmental Assessment – 2002
- Safeguard Policy Statement- 2009

ADB

谢谢！

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AECOM

移民/Re---Settlement

Voluntary Resettlement 自愿移民

Involuntary Resettlement 非自愿移民



ADB

白银亚行贷款项目（II期）项目准备技术援助 培训之：

亚洲开发银行非自愿移民政策与程序
ADB Involuntary Resettlement Policy and Procedures

ADB

非自愿移民
Involuntary Resettlement

移民的过程包括： A process that includes

…项目影响（包括房屋和土地）Displacement…(house and land)

…搬迁… Relocation…

…重新安置… Resettlement…

… 家园恢复 Rehabilitation and

…收入恢复 Income Restoration

ADB

亚行项目的目标
ADB Development Goals

- 项目应该给人们带来的是更高的生活水平，特别是对于那些贫困人口以及其他弱势群体。
- 确保项目按照亚行的社会保障政策执行

  －主要原则– 不应有人因为项目受到损害，特别是当其他人受益的时候

- Projects should lead to enhanced living standards, especially for the poor and other vulnerable groups
- Ensure Projects comply with ADB safeguard policies

  －Key principle – nobody should be made worse off, especially while others benefit

ADB

主要原则

Key Policy Objectives

Informal dwellers have rights 非正式的居民拥有相应权利

Assist **vulnerable** groups 协助脆弱群体

Budget 足够的预算

Implementation arrangements 实施的安排与工程进度的协调

ADB

亚行非自愿移民政策的主要原则和要求

Key Principles and Requirements of ADB's Policy on Involuntary Resettlement

- Policy on Involuntary Resettlement (1995)
- Handbook on Involuntary Resettlement (1998)
- OM F2 BP/OP Involuntary Resettlement (2003, 2006)
- Safeguard Policy Statement (2009)-safeguard requirements 2: involuntary resettlement

ADB

移民政策适用范围

Scope and Application

Applies to public/private sector 同时适用于公共/私营部门

In anticipation of ADB assistance,

associated facilities 与亚行项目关联的当地项目

- conduct due diligence 尽责调查
- prepare retrofit plan if required 如需要准备补救的移民计划

Not limited to relocation 不局限于搬迁

ADB

主要原则

Key Policy Objectives

Avoid IR 避免移民

Minimize IR 减少移民

Restore standard of living to at least original standards of living (AP should not be worse off) 至少达到收入恢复

Replace and **compensate** lost assets 重置和补偿财产损失

Integrate IR in project design 项目设计中包括移民

ADB

符合条件的受影响人

Eligible Affected Persons (APs)

Before Cut-off Date:截止日期之前：

- Titled 拥有正式权利的
- Legalizable 需要合法化论证的
- Non-titled 没有正式权利的

After Cut-off Date: None 截止日期之后：没有

ADB

主要原则

Key Policy Objectives

Inform and **consult** APs 通知并与受影响人协商

Disclose information 信息公开

Protect social/cultural institutions 保护当地社会/文化

Set cut-off date 设置截止日期

ADB

项目周期中的移民工作

Addressing Resettlement in the Project Cycle

ADB

显著性的非自愿移民

IR Significance

200 or more APs 受影响人口达到200人及以上

- physically displaced 居所搬迁
- 10% or more of productive assets are lost. 损失生产性资产10%及以上

ADB

项目鉴别阶段

Project Identification

Concept Paper 项目概念书

Screen IR impacts 梳理移民影响

Categorize 分类

Project profile, update regularly 根据项目内容及时更新

ADB

项目分类Project Categorization

IR Cat	Impact 影响	Reports Required
A	Significant 显著	Full RPs 完整移民计划
B	Less Significant 不显著	Short RPs 短移民计划
C	No impact	None 不需要

RF – Sector/Hybrid/Emergency loans

移民框架－行业、混合、紧急贷款项目

ADB

项目准备技援PPTA

TA Paper – TOR, IPSA 技援文件－工作大纲，初始贫困与社会评价

IR category – update? 移民分类－更新？

Consultants—Resettlement Specialist 移民咨询专家参与技援

TA completion: Draft RP/RF, subproject RP 技援需要完成移民计划/框架、子项目移民计划初稿

- Should be satisfactory for appraisal 满足项目评估要求
- OD specialist to review/comment 业务局移民专家检查移民计划并提出修改意见
- Forward to Environment and Social Safeguard Division (RSES) with operational division (OD) specialist's comment 递交给环境与社会保障处

ADB

亚行对成员国的援助

ADB Assistance to DMCs

TAs, RETAs for IR policy 对成员国的非自愿移民政策提供技援

Training, Hands-on 培训

PPTA 项目准备技术援助

Eligible costs through loan funds

贷款支付移民中的合格费用

ADB

职员审查委员会/第二次管理层会议

SRC/2nd MRM

Outstanding 1st MRM issues 主要问题讨论

Check loan covenants, loan agreements circulated 检查贷款约定和协议

Forward revised RP/RF to RSES 递交修改后的移民计划

ADB

贷款现场考察

Loan Fact Finding

Review draft RP 现场检查移民计划初稿

Raise interdepartmental comment 提出部门意见

Verify AP consultations/disclosure 查验与受影响人的协商及信息公开事宜

Confirm：确认：

- RP disclosure：移民计划的公开
- EA endorsement of RP/RF 执行机构签署移民计划/框架

ADB

贷款谈判

Loan Negotiations

Confirm RP approval before civil works contracts awards 在土建合同授予之前移民计划需要得到最终审批

RP update/disclosed on detailed design 根据详细设计更新移民计划并公开

ADB

管理层会议

Management Review Meeting (MRM)

Submit draft RP/RF提交移民计划/框架初稿

Confirm：确认

- RP disclosure to APs 计划公开
- EA endorsement of RP/RF 计划签署

Reflect IR info in Summary Poverty Reduction and Social Strategy (SPRSS) 减贫与社会策略概要中体现非自愿移民事项

ADB

贷款批准

Loan Approval

Upload RP/RF on ADB web site (mandatory) 移民计划完稿后在ADB网站公布 （强制性）

ADB

项目评估

Appraisal

Satisfactory RP/RF before appraisal 评估团之前移民计划要基本满意

Draft RP/RF upload to ADB website 计划初稿上ADB网站

RP/RF revisions: MRM comments, Safeguards Policy Compliance Memo (SPCM) 根据会议意见与合规检查，进一步修改计划

Assurances, covenants 协议约文

Supervision consultants' TOR 检查咨询专家的工作大纲

Outstanding issues as conditions 主要的问题

ADB

贷款执行中RSDD的任务

Loan Implementation: RSDD

Chief Compliance Officer approves **Full RPs** 主任合规官员批准完整移民计划

- Updated based on detailed design 根据详细设计更新的
- Non-core subprojects 非核心子项目的
- Unanticipated IR impacts 前期未预料的
- Changes in project scope 项目范围变更

RSES conducts IR safeguard review missions 移民特别检查团

ADB

贷款启动团：项目管理手册

Loan Inception : PAM

- Resettlement specialist's participation 移民专家的参与
- Review RP/RF implementation requirements 检查计划实施并提出要求
- Include IR budget, schedule, consulting service packages 包括预算、时间表、咨询专家安排
- EAs, IAs, contractors' and supervision consultants' compliance with RP 执行机构、实施机构、承包商以及监理遵守计划情况

ADB

项目完工报告

Project Completion Report

Concise history of IR activities 简述移民实施的情况

Evaluate RP/RF implementation, loan covenants 评价计划实施以及贷款约文的执行情况

Assess EA's performance 评价执行机构的表现

Summarize external M&E reports 对外部监测报告的总结

Identify outstanding compliance issues, recommend actions 识别主要遗留问题。并提出建议。

ADB

贷款启动团：项目管理手册

Loan Inception : PAM

- RP updating, disclosure after detailed design 详细设计后的计划更新与公开
- TOR/Recruitment 工作大纲
  - External M&E 外部监测
  - NGO RP Implementer 计划实施者
- Non-core subproject RP preparation 非核心子项目的移民计划准备

ADB

项目准备阶段亚行与国内程序的协调

Coordination of ADB and PRC Procedures during the Project Preparation

ADB

贷款执行过程中业务部门的任务

Loan Implementation: OD's Role

Cat A 类别A

Review RP preparation before implementation 检查移民实施前的准备

Visit sites 现场考察

Reviews progress reports, M&E reports, audit reports 检查进度报告、监测报告以及审计报告

Cat B, in addition to above 类别B，除以上外：

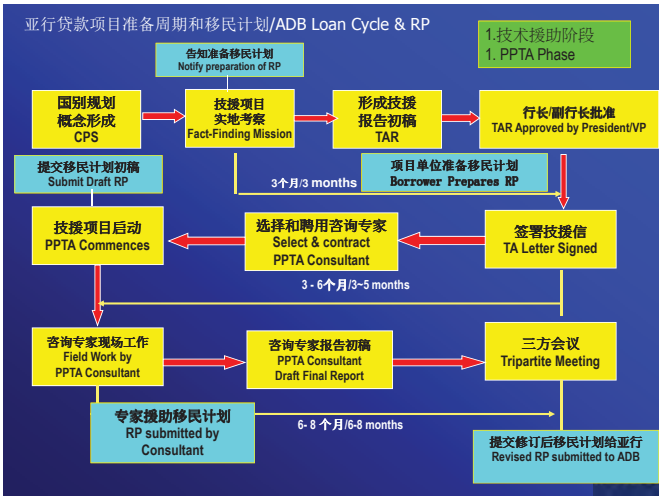
Resettlement specialist approves 移民专家审批

- Short RPs 短移民计划
- Any IR actions before award of civil works contracts, contract mobilization or similar mechanism 土建合同授予及生效之前移民行动

ADB

谢谢！Thanks!

ADB



ADB

Procurement Guidelines and Procedures
亚洲开发银行采购指南与程序

January 2014 (Baiyin)
2014年1月（白银）

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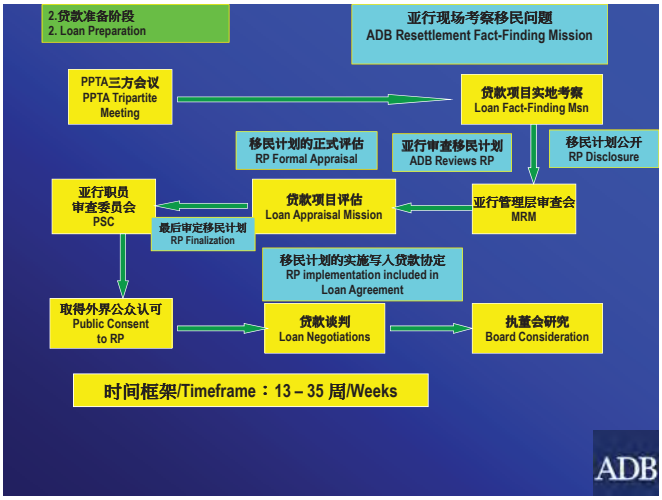

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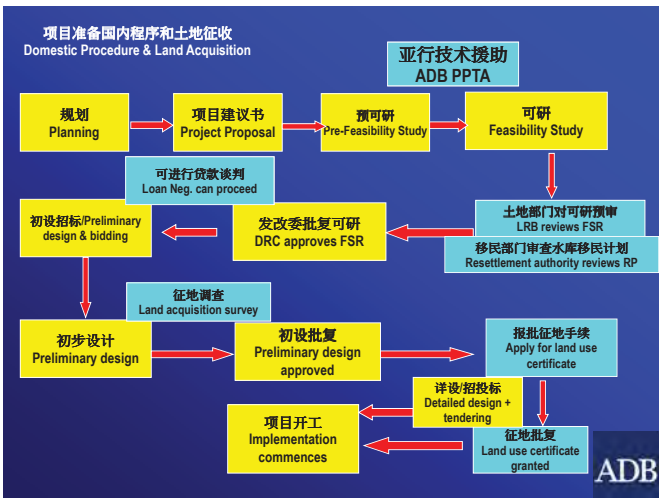
Overview 概述

1. Procurement Basics 采购基本介绍
2. Procurement Preparation 采购准备工作
3. Pre/Post qualification 资格审查
4. Bidding 招标
5. International Competitive Bidding 国际竞争性招标
6. Other Forms of Procurement 其他采购方式
7. Bid Evaluation and Award of Contract 评标与授予合同
8. ADB's Review of Procurement
亚行对采购的审查程序

2



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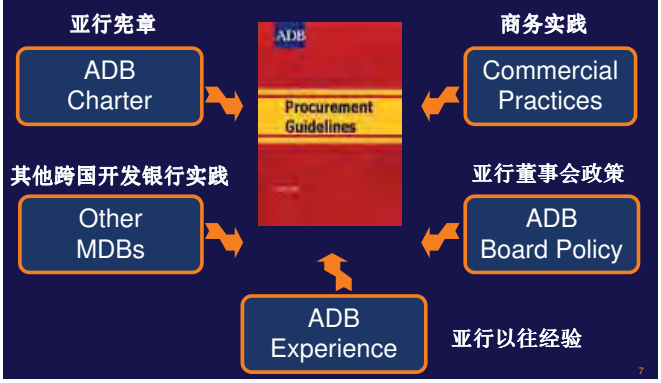
1.Procurement Basics采购基本介绍
Policy and Procedures **政策与程序**

- ***Procurement Guidelines 采购导则***
- Covers Goods, Works, Turnkey (Plant) contracts 涵盖货物、工程及交钥匙工程合同
- Supporting Documents (SBDs) 相关文件：标准招标文件
- Maintained by ADB 亚行负责维护相关的政策与程序

1. Procurement Basics
采购基本介绍

1.Procurement Basics 采购基本介绍
Sources **导则的来源**



1.Procurement Basics 采购基本介绍

- Procurement Flow Diagram 采购流程图
- Policy and Procedures 政策与程序
- Sources 导则的来源
- Responsibility for Procurement Actions 采购责任
- Eligibility 合格性
- Basic Principles 基本原则
- Fraud and Corruption 欺诈与腐败
- Applicability 适应性
- Misprocurement 错误采购
- Review of Procurement Actions 采购程序总揽

1.Procurement Basics采购基本介绍
Responsibility for Procurement Actions **采购责任**

- The Borrower (Executing Agency) is responsible for all procurement activities 借款人（执行机构）对所有采购活动负最终责任
- **ADB's Role**:
- Review the procurement activities to ensure the Guidelines are followed 亚行审查采购活动，保证遵守亚行的采购指南
- Declare misprocurement in case the agreed procedures not followed in any material respect 对已经同意的程序未实质性执行的情况，宣布错误采购
- ADB Procedures should be followed for contracts financed wholly or partially by ADB 部分或全部使用亚行贷款的合同都必须遵守亚行采购指南和程序

1.Procurement Basics采购基本介绍
Procurement Flow Diagram **流程图**

1.Procurement Basics采购基本介绍
Fraud and Corruption **欺诈与腐败**

Corrupt Practice 腐败行为

Fraudulent Practice 欺诈行为

Collusive Practice 共谋行为

Coercive Practice 强迫行为

1.Procurement Basics采购基本介绍
Eligibility 合格性

- Procurement is in member countries 采购是在亚行成员国
- Goods and services are produced in and provided from member countries. 货物和服务必须生产于或提供于亚行成员国

Other Eligibility Factors 其他因素

- No conflicts of interest 没有利益冲突
- Not sanctioned by ADB or UN 没有受过联合国或亚行的制裁
- State-owned enterprises 国有企业
- Military of a borrowing country 军工单位

1.Procurement Basics采购基本介绍
Fraud and Corruption **欺诈与腐败**

Corrupt Practice 腐败行为

Fraudulent Practice 欺诈行为

Collusive Practice 共谋行为

Coercive Practice 强迫行为

The offering, giving, receiving, or soliciting, directly or indirectly, of any thing of value to influence the action of any party in the procurement process or the execution of a contract

直接或间接地献礼、赠与、收受、或索取任何有价物，以影响任何一方在采购过程中或合同执行过程中的行为

1.Procurement Basics 采购基本介绍
Eligibility 合格性

- Exceptions 不具备合格性的情形：
  - Prohibited by United Nations Security Council on any import of goods from, or payment to, a country, person or entity. 被联合国安理会禁止出口到，或者支付给某国家，个人或经济实体。
  - Engaged by the borrower to provide consulting services for the project preparation, and any of its affiliates 在该项目的准备过程中，曾被借款人雇用的公司及其分支机构
  - Government owned enterprises, if cannot establish that: 不具备以下条件的国有企业：
    - Legally and financially autonomous 法律和财务上自治
    - Operate under commercial law, and 在商业法律下运作
    - Not dependent agencies of the borrower 借款人附属机构
    - Declared ineligible by ADB in accordance with Clause related with 为亚行宣布为不合格的企业

1.Procurement Basics采购基本介绍
Fraud and Corruption **欺诈与腐败**

Corrupt Practice 腐败行为

Fraudulent Practice 欺诈行为

Collusive Practice 共谋行为

Coercive Practice 强迫行为

A misrepresentation or omission of facts in order to influence a procurement process or the execution of a contract

提供不真实或疏忽的证据，以影响采购过程或合同的执行

1.Procurement Basics采购基本介绍
Basic Principles **基本原则**

Economy and Efficiency **经济性和效率原则**
Borrowers to obtain goods and services through ICB unless other forms of procurement are more suitable 借款人尽可能采用国际竞争招标

Fairness **公平原则**
Procurement activities should give member countries an adequate, fair and equal opportunity to supply goods and services 给予成员国充足、公平和平等的机会来提供货物与服务

Transparency **透明原则**
To achieve economy and efficiency and to combat fraud and corruption 要达到经济性和效率性，惩治欺诈与腐败

1.Procurement Basics采购基本介绍
Applicability 适用性

Contracts financed by ADB entirely or partly 亚行全部或部分贷款的合同

- ADB System must be followed 必须遵守

Contracts not financed by ADB 非亚行提供资金的合同

- Borrower's procurement procedures apply 借款人的采购程序
- Must be suitable for the project 必须适合该项目

1.Procurement Basics采购基本介绍
Fraud and Corruption 欺诈与腐败

Corrupt Practice 腐败行为

Fraudulent Practice 欺诈行为

Collusive Practice 共谋行为

Coercive Practice 强迫行为

A scheme or arrangement between two or more bidders, with or without the knowledge of the Borrower, designed to influence the action of any party in a procurement process or the execution of a contract

在两个或者多个投标人之间，在知会或不知会借款人的情况下进行的一种计划或者安排，，以期影响任何一方在采购过程中或合同执行过程中的行为

1.Procurement Basics采购基本介绍
Misprocurement 错误采购

- If procurement is not carried out as agreed in accordance with the provisions of the financing agreement and these Guidelines, ADB will declare misprocurement. 如果采购活动不是按照根据融资协议和有关指南所约定的条款进行，亚行将宣布该行为是错误采购
- If misprocurement is declared, ADB will: 如果宣布为错误采购，亚行将：
  - cancel that portion of the financing allocated to the goods and works that have been mis-procured. 取消与错误采购有关的部分的货物或工程的融资；
  - In appropriate cases, ADB may permit rebidding 在适当的情形下，进行重新招标.
  - exercise other remedies provided for under the financing agreement. 依据融资协议采取其它补救措施
- Even if a contract is awarded after obtaining a no objection from ADB, ADB reserves the right to declare misprocurement if it concludes that the no objection was issued on the basis of incomplete, inaccurate, or misleading information or the terms and conditions of the contract had been substantially modified without ADB's approval.
- 即使合同是在取得亚行的不反对意见之后授予的，如果发现该不反对意见是建立在不完整，不准确，存在误导，或在未取得亚行的批准的情况下对合同条款进行了实质性修改的基础上，亚行仍保留宣布错误采购的权利

1.Procurement Basics采购基本介绍
Fraud and Corruption 欺诈与腐败

Corrupt Practice 腐败行为

Fraudulent Practice 欺诈行为

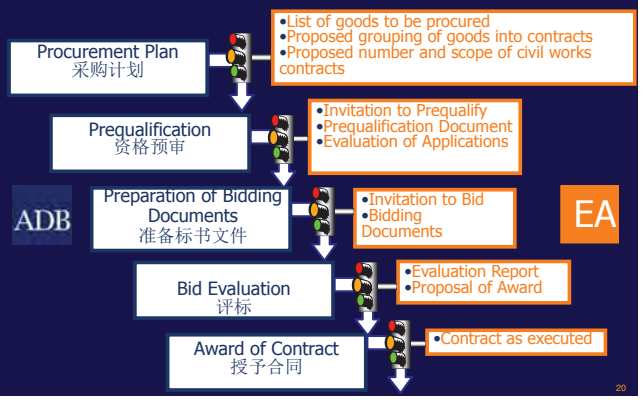
Collusive Practice 共谋行为

Coercive Practice 强迫行为

The harming or threatening to harm, directly or indirectly, persons, or their property to influence their participation in a procurement process, or affect the execution of a contract

直接或间接伤害或威胁伤害个人及其财产，以期影响他们在采购过程中的参与，或影响合同的执行

1.Procurement Basics采购基本介绍
Review of Procurement Actions 采购程序总揽



1.Procurement Basics采购基本介绍
Fraud and Corruption 欺诈与腐败

ADB's Anticorruption Policy requires all parties to observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB will

各方均要遵守最高的伦理标准，否则亚行将：

- Reject a proposal to award contract 拒标
- Cancel the portion of a loan 取消部分贷款
- Declare a firm ineligible either indefinitely or for a stated period of time 宣布该公司不再或在一定时期内不能参与亚行项目投标
- Inspect accounts and records of suppliers and contractors and have them audited by auditors appointed by the Bank 检查供货商和承包商的帐务和记录，并指派审计人员进行审计

2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划

- Over $100,000 in value, list all packages by procurement method and the date by which procurement activity to commence.
- 十万美元以上：列出所有合同，包括采购方式，和开始执行的日期
- Below $100,000, the method of procurement is to be indicated 十万美元以下，只列出采购方式

- prepared by the borrower, be annexed to the RRP
- 由借款人准备，是RRP/PAM的一个附件
- not a substitute for a project implementation schedule which details the major activities 不可替代项目实施计划，
- be updated annually on a rolling 18-month basis.
- 每年更新，以18个月为滚动周期
- Not required to publish Procurement Plan locally, but encouraged to do so. 鼓励但不要求必须在当地公开发布。

2. Procurement Preparation 采购准备工作

- EA Capacity Assessment 执行机构的能力评估
- Procurement Plan 采购计划
- Advanced Procurement Action 提前采购活动
- Use of Agencies 招标代理的使用
- Bid Packaging 合同分包

2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划

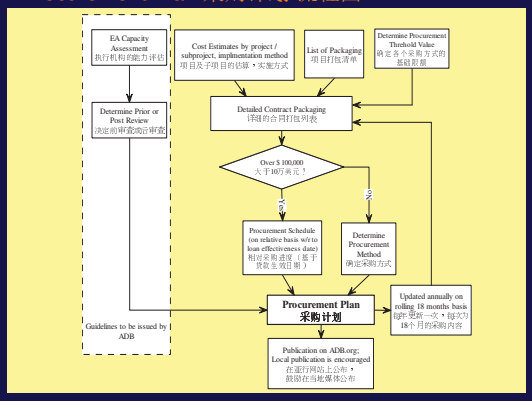
- Contents 内容：
- The particular contracts for goods, works, and consultants services 货物，工程和咨询服务合同
- The proposed method of procurement of such contracts 每个合同的采购方式
- The related ADB procedures 相关的亚行程序

- Threshold values for procurement methods to be applied 各个采购方式的基础限额
- The procurement that will be subject to ADB's post review 需要亚行后审查的采购合同
- A list of significant procurement packages with milestone dates 主要合同包清单，包括关键日期

2. Procurement Preparation 采购准备工作
EA Capacity Assessment 执行机构的能力评估

- Purpose: 目的：
- identify the capacity, procedural and organizational constraints that will hinder effective Project implementation and agree an action plan to address these constraints; 确定在能力、程序和机构方面对有效的项目实施带来障碍的制约因素，并同意采取相应措施的行动计划
- determine the overall procurement risk and put in place appropriate review and supervision processes and thresholds to mitigate those risks, 决定总的采购的风险，并采取相应的检查和监督程序， 来减低这些风险
- To the maximum extent possible and sensible, ensure that procurement is undertaken by the regular line units within the EA, agreeing in the action plan measures to strengthen and support these units when necessary thereby ensuring that EA capacity is built beyond the project's lifecycle. 达到最大程度，以确保采购活动是由执行机构的常规部门来完成， 行动计划中的措施要加强并支持这些部门的能力建设，如果需要，在项目周期之外继续执行机构的能力建设

2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划 流程图



2. Procurement Preparation 采购准备工作
EA Capacity Assessment 执行机构的能力评估

- The Capacity Assessment will become a requirement of the detailed procurement plan guide and be used to justify review procedures, including the introduction of post review
- 能力评估将成为采购计划指南的所要求完成的一个部分，并将用来评估亚行的审查程序（包括使用后审查的方式）

- Until the detailed guide is issued, including instructions on doing capacity assessment, capacity assessments are not required and post review procedures should not be proposed.
- 在采购计划指南（包括能力评估的方法）颁布之前，能力评估暂不作要求，同时后审查程序也不可以使用

2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划
List of contract packages in excess of $100,000 *Illustration only*

Ref	Contract Description	Estimated Cost	Procurement Method	Expected Date of Advertisement	Prior Review Y/N	Comments
Consulting Services – Request for EoI						
Invitations to Prequalification:						
Works:						
Subproject 1:						
Subproject 2:						
Invitations for bids:						
Works:						
Subproject 1:						
Subproject 2:						
Goods:						
Subproject 1:						
Subproject 2:						

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2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划

Project Information	
Country	P. R. China
Name of Borrower	
Project Name	
Loan or TA reference	
Date of Effectiveness	
Amount US$	
Of which committed, US$	
Executing Agency	
Approval Date of Original Procurement Plan	
Approval of most recent Procurement Plan	
Publication for Local Advertisements	
Period covered by this procurement plan	

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2.Procurement Preparation 采购准备工作
Bid Packaging 划分采购包

- Principles 原则
  - Types of Contracts 合同类型
  - Methods of Procurement 采购方式

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2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划
Procurement Thresholds – Goods & Related Services, Works and Supply and Install (*Illustration only*)

Procurement Method	To be used above (Value $)
ICB Works	>$10,000,000
ICB Goods	>$1,000,000
NCB Works	<$10,000,000
NCB Goods	<$1,000,000
Shopping Works	<$100,000
Shopping Goods	<$100,000
Exceptional Methods:	
LIB	<$1,000,000
Direct contracting	For specialized agencies
Force account	

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2.Procurement Preparation 采购准备工作
Types of Contract 合同类型

Type and Size of Contracts 合同的类型和大小

- Contract size to attract international competition 吸引国际竞争
- Supply Contracts involve delivery of goods to location indicated in the contract. May include related services such local handling and transportation, installation, testing and commissioning, training, etc.. **供货合同**
- Works Contracts involve execution of works. Unit price contracts or lump sum price contracts or combination of both for different portions of contract **工程合同**
- Turnkey (Plant) Contracts for design, supply and installation of a complete plant through a single contract **交钥匙工程合同**

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2. Procurement Preparation 采购准备工作
Procurement Plan 采购计划
Procurement Thresholds – Consulting Services *Illustration only*

Procurement Method	To be used above (Value $)
Quality Cost Based Selection (QCBS)	>$200,000
Consultants Qualification Selection (CQS)	<$200,000
Least Cost Selection (LCS)	<$100,000
Alternative Methods:	
Quality based selection (QBS)	
Single source selection (SSS)	

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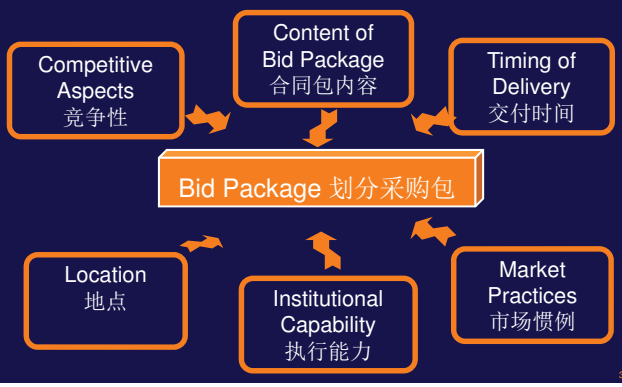
2.Procurement Preparation 采购准备工作
Methods of Procurement 采购方式

- International Competitive Bidding (ICB) 国际竞争性招标
- Limited International Bidding (LIB) 有限国际国际招标
- National Competitive Bidding (NCB) 国内竞争性招标
- Shopping 询价采购
- Direct Contracting 直接签订合同
- Force Account (FA) 自营工程
- Procurement under BOO/BOT/BOOT 基于 BOO/BOT/BOOT 的采购
- Performance-Based Procurement 基于性能的采购

2.Procurement Preparation 采购准备工作
Types of Contract 合同类型

- Supply Contracts 供货合同
  - Supply only 供货
    - Delivery of equipment or materials to location indicated in the contract
  - Supply and Related Services 供货及相关服务
    - Includes supply, delivery, installation, testing and commissioning of equipment at site, training, etc..

2.Procurement Preparation 采购准备工作
Bid Packaging 划分采购包



2.Procurement Preparation 采购准备工作
Types of Contract 合同类型

Civil Works Contracts 土建工程合同

- Unit Price Contracts 单价合同
  - Unit price is fixed but contract price subject to adjustments based on measured actual performance during implementation (quantities of goods or works to be procured is not precisely known but estimated during bidding), e.g. road contract
- Lump Sum Contracts 总价合同
  - Fixed price based on quantities of goods to be used in project that can be determined precisely prior to bidding, e.g. building contract

2.Procurement Preparation 采购准备工作
Advance Procurement Action 提前采购

- APA - the process for procuring goods and works before the date of loan effectiveness or approval of TA.
- 提前采购－是指在贷款生效日期或技援项目批准日期之前进行的采购活动
- APA may include approval of the award of contract for the procurement of goods and related services and works if RF has also been approved.
- 如果追溯贷款已经批准，提前采购活动可以包括对采购合同进行授标的批准
- Retroactive financing (RF) refers to the ADB's approval in principle to finance project expenditures prior to the loan or TA becoming effective.
- 追溯贷款是指在贷款生效之前亚行原则上批准为项目的开销进行融资

2.Procurement Preparation 采购准备工作
Types of Contract 合同类型

- Plant – Design, Supply & Install Contract 交钥匙工程合同
  - Also known as turnkey contract
  - Where the design, supply of equipment, and the testing and commissioning of a complete plant or installation is provided through a single contract (single responsibility contract)
  - Consider when institutional capacity of EA is inadequate to administer various individual contracts
  - Cost will be slightly higher, but administrative costs will be less

3. Pre/Post qualification
资格审查

2.Procurement Preparation 采购准备工作
Advance Procurement Action 提前采购

- Where APA is approved, the EA must be advised : 如果提前采购得到批准，执行机构必须：
  - To seek ADB's approval for the draft prequalification and bidding documents before they are issued;
  - 资审和招标文件在发布之前要取得亚行的批准
  - To follow requirements for public advertising ;
  - 满足发布广告的要求
- **Note** that ADB's approval of APA will not commit ADB to subsequently approve the project or to finance the procurement costs;
- 注意：亚行对提前采购的批准不代表亚行一定批准对该项目或该采购活动的融资
- **Note** that ADB will not finance expenditures paid by the borrower prior to loan effectiveness, even if APA is approved, unless RF has also been approved by ADB.
- 注意：除非追溯融资得到批准，亚行不会在贷款生效之前对执行机构的有关支出进行融资，即使批准了提前采购

3. Qualification
Prequalification 资格预审

Purpose 目的

to ensure that bids are submitted only by firms that have the necessary qualifications in terms of 保证标书只由具备资格的公司呈交：

- Eligibility 合法性
- Experience 相关经验与以往的业绩
- Financial Capacity 财务能力
- Pending Litigation 未决的法律诉讼

to undertake the work for which bids are to be invited.
来承担该项工程

2.Procurement Preparation 采购准备工作
Use of Agencies 代理的使用

Specialized Agencies: 专业代理

- The Procurement Guidelines allow for direct procurement from specialized agencies. 亚行采购指南允许使用专业代理来进行直接采购
- The use of specialized agencies should be identified in the procurement plan. 使用专业代理必须在采购计划中明示
- Procurement from the agency would follow direct contracting procedures, it must be satisfied of eligibility requirements. 专业代理的采购必须遵照直接采购的程序， 其程序必须满足基本合格性的要求

3. Qualification
Prequalification 资格预审

Prequalification process used for large and complex：
资格预审用于大型和复杂的：

- Civil Works Contracts 土建工程合同
- Turnkey (Plant) Contracts 交钥匙工程
- Contracts for Fabrication of Expensive or Technically Complex Items or Equipment 制造/装配价格昂贵或技术上复杂的构件或设备的合同

2.Procurement Preparation 采购准备工作
Use of Agencies 代理的使用

Procurement agents 采购代理

Management Contractor 项目管理承包商

Construction Manager 施工管理商

- The practices followed by the agent must comply with the Guidelines, the procurement plan, and the financing agreement. 代理的工作必须遵守亚行采购指南，采购计划和融资协议的要求
- The agent should be selected following procedures for consultant recruitment. 代理的选择必须依照亚行聘用咨询的程序

Inspection agents 监理代理

- To fulfill inspection requirements of procurement. 完成采购中对监理工作的要求
- The agent should be selected following procedures for consultant recruitment. 代理的选择必须依照亚行聘用咨询的程序

4. Bidding 招标
Bidding Procedures 招标程序

Single-Stage: One-Envelope 单步单信封

Single-Stage: Two-Envelope 单步双信封

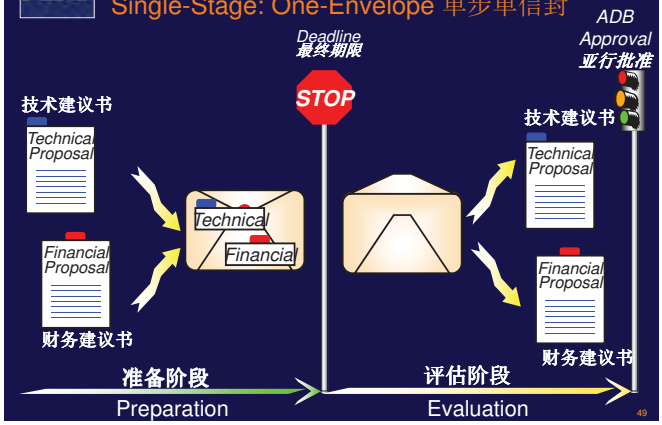
Two Stage: 两步法

Two-Stage: Two-Envelope 两步双信封

3. Qualification
Prequalification 资格预审

- Prequalification Procedures 资格预审的程序
  - Advertisement 广告
  - Issuance of Prequalification Documents 发布资格预审文件
  - Evaluation 评估
- Qualification and Evaluation Criteria 资格预审的审查和评估
  - Financial 财务方面
  - Technical 技术方面
  - Experience 相关的以往经验

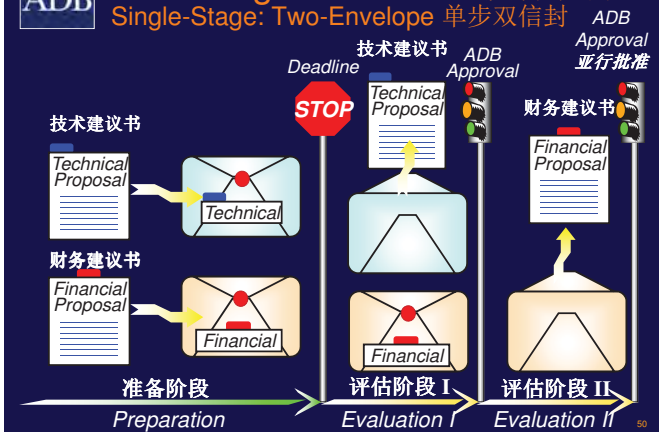
4.Bidding Procedures 招标程序
Single-Stage: One-Envelope 单步单信封



3. Qualification
Post qualification 资格后审

- For contracts where prequalification is not required, information on bidders' qualifications can be submitted together with the bids 用于不要求资格预审的合同，资格审查的资料可以与标书同时呈交
- The information on qualifications will be assessed during bid evaluation 资格审查的资料将在评标过程中进行审查

4. Bidding Procedures 投标程序
Single-Stage: Two-Envelope 单步双信封

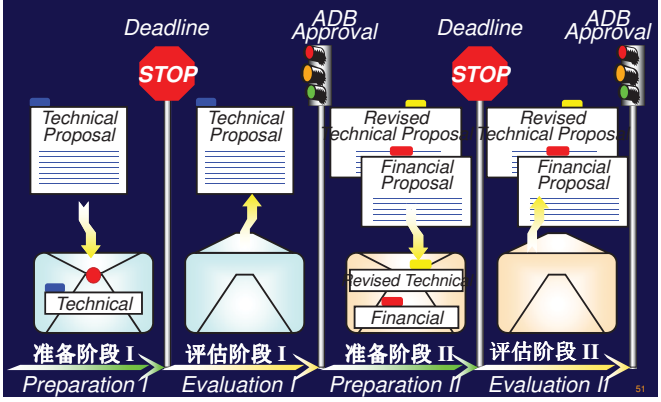


4. Bidding 招标

5. International Competitive Bidding
Applicability 国际竞争性招标 — 适用性

- ADB requires to obtain goods and works through ICB 亚行要求采用ICB获得货物和工程
- Thresholds of contracts for ICB in PRC 在中国ICB适用于：
  - Goods above $1,000,000 货物合同100万美元以上
  - Works above $10,000,000 土建合同1000万美元以上

4. Bidding Procedures投标程序
Two Stages 两步法

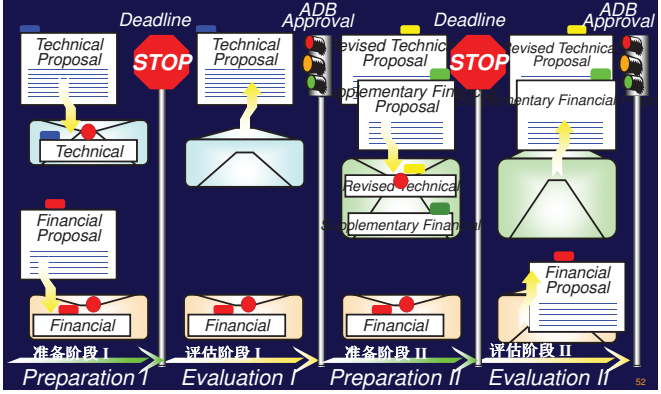


5. International Competitive Bidding
Invitation for Bids (IFB) 投标邀请书

- Purpose 目的
  - A notice to inform potential Bidders about requirements and invite interested Bidders to bid 通知潜在投标商有关的要求和有兴趣者参与投标
- Particulars 细节
  - Name of Borrower 借款人名称
  - Name of Project 项目名称
  - Description of Works/ Goods 工程/货物的描述
  - Purchasing unit 购买标书数量
  - Mailing address of office for inquiry and issuance of bid documents 邮寄地址
  - Price of bidding document 标书价格
  - Date, time, and place of bid opening 开标时间地点
  - Amount or percentage of bid security 投标保函金额
  - Advice on domestic preference 国内优惠

IFB does not form part of the Bidding Document! IFB非标书组成部分

4. Bidding Procedures 投标程序
Two-Stage: Two-Envelope 两步双信封



5. International Competitive Bidding
Advertisement and Notification 广告与通知

Prequalification 资格预审

- Invitation for bids only to prequalified bidders 只邀请通过了资格预审的投标商
- But advertisement for P/Q in English newspaper of general circulation 但必须在一家广泛发行的英文报纸上刊登资格预审广告

Post qualification 资格后审

- Advertisement in English language newspapers of general circulation 必须在一家广泛发行的英文报纸上刊登广告
- Publication in ADB Business Opportunities 刊登在亚行商机上

5. International Competitive Bidding
国际竞争性招标

5. International Competitive Bidding
Bidding Documents 招标文件

Essential Features： **基本特征：**

- Use of SBDs 使用SBD
- Reference to Bank 提交亚行参考
- Language 语言 －英文
- Clarity 清楚明确
- Bid Security 投标保函
- Conditions of Contract 合同条件
- Standards 标准
- No use of Brand Names 不许使用特定的商标名称
- Source of Procurement 采购来源
- Pricing 价格
- Currency of Bid 货币
- Currency of Bid Comparison 评标比较货币
- Currency of Payment 支付货币
- Terms of Payments 支付条件
- Price Adjustment Provisions 调价条款
- Advance Payment 预付款
- Performance Security 履约保函
- Retention Money 保留金
- Insurance and Transportation 保险和交通
- Liquidated Damages 违约偿金
- Force Majeure 不可抗力
- Settlement of Dispute 争议的解决

5. International Competitive Bidding
Bidding Documents 招标文件

Bidding Documents shall : 招标文件必须：

- Comply with requirements of the Bank's Guidelines 符合亚行采购指南
- Comply with agreed modifications or departures from the Guidelines 符合经亚行同意的对采购指南的修改和偏离
- Comply with the format of the Bank's appropriate Standard Bidding Documents (SBDs) 符合亚行标准招标文件文本的格式

I. Instructions to Bidders (ITB) 投标人须知

- Purpose 目的
  - to specify general procedures that regulate the bidding process 规定投标过程的一般程序
- Content 内容
  - standard clauses that have been designed to remain unchanged, and to be used without modifying their text 不可更改的标准条款

5. International Competitive Bidding
Bidding Documents 招标文件

- Standard Bidding Documents 标准招标文件
  - Procurement of Goods 货物的采购
  - Procurement of Works 土建工程的采购
  - Procurement of Plant – Design, Supply and Install (Turnkey) 交钥匙工程的采购

II. Bid Data Sheet (BDS) 基本资料

- Purpose 目的
  - to provide information specific to a particular bidding process in order to supplement the information or requirements of Section 1 提供真对特定的投标过程的信息，并作为第一节的补充
- Consists of 包括：
  - clauses which are numbered with the same numbers as the corresponding clauses of Section 1 - Instruction to Bidders 有关条款编号与投标人须知相对应

5. International Competitive Bidding
Standard Bidding Documents 标准招标文件

Part 1: Bidding Procedures 投标程序
- Section I. Instruction to Bidders 投标人须知
- Section II. Bid Data Sheet 基本资料
- Section III. Evaluation and Qualification Criteria 评估和资审条件
- Section IV. Bidding Forms 投标书格式
- Section V. Eligible Countries 有资格的国家

Part 2: Requirements 要求
- Section VI. Schedule of Supply/Employer's Requirements 供货清单/业主的要求

Part 3: Contract 合同
- Section VII. General Conditions of Contract 通用条款
- Section VIII. Special Conditions of Contract 特别条款
- Section IX. Contract Forms 合同格式
- Section X. Procurement Plan 采购计划

VI. Schedule of Supply (SS) – for Goods
供货计划 – 货物采购

- Purpose 目的
  - to provide complete, precise, and clear information to enable bidders to prepare efficiently and accurately Bids that are realistic and competitive 提供完整、精确和清楚的资料，使投标人能够有效和准确地提交现实和具有竞争力的标书
- Goods SBD Parts 货物采购的标准招标文件
  1. List of Goods and Related Services 货物和相关服务清单
  2. Delivery and Completion Schedule 供货计划
  3. Technical Specification 技术规格
  4. Drawings 图纸

III. Evaluation & Qualification Criteria
评估及资审条件

- Purpose 目的
  - to specify criteria that the Purchaser will use to evaluate the Bids and post qualify the lowest evaluated Bidder 规定特定的条件，购买人用来评标和资格后审最低价格投标人
- User's Guide suggested criteria 指南手册建议的条件
  - not all need to be used 不是所有的条件都必须使用

VI.Employer's Requirements – for works
业主要求 – 土建工程采购

Works 土建工程

1. Specifications 技术规范
2. Drawings 图纸
3. Supplementary Information 附加资料

IV. Bidding Forms 投标书格式

- Forms provided by the Purchaser/Employer that the Bidder must complete and include in its Bid 由购买人/业主提供的投标人必须完成并包括在标书中的表格
- Bidding Forms are: 主要包括：
  - Bid Submission Sheets/ Letter of Bid 投标书
  - Price Schedules / Bill of Quantities 价格清单/工程量表
  - Bid Security 投标保函
  - Manufacturer's Authorization 制造商授权

VII. General Conditions of Contract
通用合同条款

- Purpose 目的
  - to define general procedures for proper contract management through clear definitions of rights and obligations of contracting parties 通过对各方权利和义务的明确的定义，规定合同管理的一般程序
- Consist of 包括
  - standard clauses applicable to most contracts designed to remain unchanged and to be used without modifying their text 不可更动的标准文本
- Source 来源
  - evolved from accumulated experience 以往积累的经验逐渐演化而来

V. Eligible Countries 有资格的国家

- For loans from ADB's OCR 亚行普通资金贷款
  - The most recent list of ADB member countries obtainable from the 'Business Opportunities' section of www.adb.org to be used
- For loans from ADB's SF Resources 亚行特别基金贷款
  - The most recent list of ADB developed member countries which have contributed to such resources, and all developing member countries, to be used

6. Other Forms of Procurement
其他采购方式

VIII. Special Conditions of Contract 特殊合同条款

- Purpose 目的
  - define provisions that are specific to a particular bidding process in order to supplement the information or requirements of Section 7 - General Conditions of Contract 定义针对特定的投标过程的条款，并作为第七节 – 通用条款的补充
- Consists of 包括
  - clauses which are numbered with the same numbers as the corresponding clauses of Section 7 - General Conditions of Contract 有关条款编号与第七节－通用条款相对应

6. Other Forms of Procurement
National Competitive Bidding
其他采购方式－国内竞争性招标

- Procurement is done domestically, within the borrowing DMC 采购在借款人所在国国内进行
- Allowed when : 适用于：
  - Local production or construction facilities are available 当地具有生产和施工设备
  - Foreign contractors and suppliers are unlikely to be interested 外国承包商/供货商可能不感兴趣
  - Procedures for domestic procurement are acceptable to ADB 国内招标程序为亚行所接受
  - Borrower has requested for NCB 借款人要求采用国内招标
  - Are of small value and of a series of small-value works 合同额较小，由一系列小合同额的工程组成
  - Located in several areas that may be far apart in the country 分布在相距较远的地区
  - Be executed at different times 在不同的时间执行

IX. Contract Forms 合同格式

Forms provided by the Purchaser that the Bidder awarded the Contract must complete 购买人提供给欲被授予合同的投标人必须完成的文件

- Agreement Form: sample form of contract agreement 合同书样本
- Performance Security Form 履约保函
- Advance Payment Security Form 预付款保函

6. Other Forms of Procurement
National Competitive Bidding
其他采购方式－国内竞争性招标

Essentials 要点

Eligibility 适用性	All local and foreign bidders are eligible 所有当地及外国投标人
Threshold 金额限制	Works: less than $ 10 million 工程：小于一千万美元 Goods: less than $ 1 million 货物：小于一百万美元
Advertising 广告	Works: over $1,000,000 工程：大于一百万美元 Goods: over $ 500,000 货物：大于50万美元 Advertised GPN in ADB-BO & Local . (4 weeks bidding period) GNP在亚行网站和当地报纸， 投标期最小4周
Prequalification 资格预审	Individual prequalification/registration system is acceptable, if so, PQ is not required 单独进行的资格预审或注册制度； 如果亚行可以接受，不要求资格预审
Bidding Document 招标文件	The use of local language, local banks for bid securities, and local currency for bidding and payment is acceptable. 本国语言，当地银行的投标保函，投标及支付均可使用当地货币

5. International Competitive Bidding
Bidding Documents - ADB Review
招标文件 – **亚行的审查**

- Draft Invitation for Bids 投标邀请书草案
- Advertising and Publication Procedure 广告和出版程序
- Draft Bidding Documents 标书草案

6. Other Forms of Procurement
Shopping 询价采购

- Based on comparing price quotations from minimum of three suppliers/contractors 基于比较报价的方式， 最少要3个供应商或承包商
- used for procuring low-value, readily available off-the-shelf goods, or simple civil works of low value. 应用于低价格，现货供应的货物，或低合同额的土建工程
- Requirement: 要求
  - there are a sufficient number of local suppliers (or contractors for works) that can meet the requirements of the procurement and ensure a satisfactory level of price competition. 必须有足够的当地供应商或承包商满足采购要求，并确保价格竞争在一个满意的程度
  - Maximum $100,000 最高十万美元
  - Quotations by written forms, evaluation follows the same principle as of open bid, use purchase order or brief contract
  - 报价必须是书面方式，评审的原则与公开招标相同，使用订单或者简明合同的方式来确认采购

6. Other Forms of Procurement
National Competitive Bidding
其他采购方式－国内竞争性招标

Essentials	要点
Bidding Procedures 投标程序	Price negotiation with bidders before contract Award is not normally acceptable, except when all bids received are higher than the estimate. 在授予合同前的价格谈判一般是不允许的，除非所有的投标价格高于预算
	Public bid opening is required 必须公开开标
	Two-stage or two-envelope bidding is acceptable 可使用双阶段双信封程序
	Evaluation criteria must be explicitly stated in bid documents 标书文件中必须明确写明评标条件
Restrictions 限制	on sources of transportation and insurance acceptable 可以限制运输和保险的来源
Domestic Preference 国内优惠	Not acceptable. When foreign bidders participate, comparison will be on the basis of delivered price, including import duties 不适用

6. Other Forms of Procurement
Direct Contracting 直接签订合同

- Without competition (single source) 无竞争，单一来源
- Civil works are a natural extension of earlier or ongoing job 土建工程是前期或者正在进行的工程的延伸
- Standardization is important (i.e. spare parts) 标准化非常重要（如配件）
- Equipment is proprietary and obtainable only from one supplier 设备只能从某一供货商处获得
- Critical items are to be procured from specialist suppliers 关键部件只能由专业供货商生产

6. Other Forms of Procurement
Limited International Bidding
其他采购方式－有限国际采购

- Used when amount of contract is not large enough for ICB 当合同金额不足够使用ICB时采用
- Permitted for : 如下情形允许使用：
  - Contracts not exceeding US$1.0 million 合同金额小于100万美元
  - Situations when items needed are available only from few suppliers 当只有少数供货商可以提供所需货物时
  - Situations when early delivery is of paramount importance 当合同提前交货相当重要的情况下

6. Other Forms of Procurement
Repeat Order （Based on original ICB)
重复订货 (基于原ICB）

- when additional quantity of the same items procured under ICB is urgently needed to meet project requirements and proposals are invited from many responsive bidders from original tender 项目急需增加通加ICB方式采购的货物，并且建议书是来自在原招标过程中的多个具有响应性的投标人
- when the original ICB tender resulted to a clearly superior lowest bidder from few bidders 原ICB的投标人中个别投标人具有明确的超低价
  - Additional quantities shall not exceed 30% of original quantities 增加的数量不超过原来的30％
  - Repeat order follows not later than 18 months after original order with no price increase 重复订货必须在原订货的18个月内，且价格没有增加

6. Other Forms of Procurement
Limited International Bidding
其他采购方式－有限国际采购

- Invitations for bids should be issued to at least 3 suppliers/ contractors (preferably) 投标邀请最好发给至少3个供货商/承包商
- Minimum bidding period of 3 weeks 最短招标期3个星期
- Domestic preference may not be applied 国内优惠不适用
- Bids received should be opened publicly and evaluated as in the case of ICB 公开开标并采用ICB的评标程序
- Advertisement in local English newspaper preferable, not mandatory; minimum bidding period of 4 weeks 最好但不强制在当地的英文报纸上刊登广告 (4个星期）
- ADB may review after the award of contract but before disbursement 亚行可以在授标之后审查相关文件，但必须在开始支付之前

7. Bid Evaluation 评标
Public Opening of Bids – the Record 开标记录

ADB Loan :_____
Project Title:_____
Bid No.:_____ Contract No. :_____ Contract Title: _____
The following bids were received by bid closing date
On : _____ At : _____ hrs. Place : _____
and were publicly opened
On : _____ At : _____ hrs. Place : _____

No.	Name of Bidder	Bid Security Amount/Validity	Total Bid Price	Discount if any	Comments	Bidder's Signature

Signed by Bidding Committee : _____

6. Other Forms of Procurement
Force Account 自营工程

- Force account is construction by the use of the borrower's own personnel and equipment 使用借款人自己的人工和设备
- Requirement : 要求：
  - quantities of work involved cannot be defined in advance; 工程量无法预先确定
  - works are small and scattered or in remote locations for which qualified construction firms are unlikely to bid at reasonable prices; 工程小并且分算在较远的不同地区，承包商不大可能用合理的价格投标
  - work is required to be carried out without disrupting ongoing operations; 工程的实施不可影响正在进行的工作
  - risks of unavoidable work interruption are better borne by the borrower than by a contractor; or 不可避免的对工作的影响所带来的风险最好由借款人负担
  - there are emergencies needing prompt attention. 紧急情况需要立刻处理
- force account unit : A government-owned construction unit that is not managerially and financially autonomous.
- 自营工程单位：在管理和财务上不自主的政府所有的施工单位

7. Bid Evaluation 评标
Purpose 目的

Determination of the Lowest Evaluated Substantially Responsive Bid

决定具有最低评标价格且实质性响应的投标

7. Bid Evaluation and Award of Contract
评标与授予合同

7. Bid Evaluation 评标
Basics 基本介绍

Time Frame 时间要求

- The evaluation of bids and the award of contract should be completed before the expiration of the bid validity period stipulated in the bid documents 评标和授予合同应在标书规定的投标有效期内完成

Confidentiality of Procedures 保密性

- After opening of bids no information to non-authorized persons on: 开标后不能将如下信息透露给无关人员：
  - Substance of bid 投标的实质内容
  - Preliminary examination results and status 初步的评审结果和评审状态
  - Evaluation results and status 投标结果和状态
  - Recommendation for award 授标建议

7. Bid Evaluation 评标
Public Opening of Bids 公开开标

- A principal feature of the ICB, LIB and NCB methods ICB，LIB 和NCB 的一个基本特征
- Intended to give bidders assurance that all bids are treated fairly and impartially 向投标人保证公正和公平
- Opened publicly by EA at time and place indicated in the bidding documents， or posted online for e-bidding 执行机构在招标文件中规定的时间和地点公开开标， 或者如使用电子采购，可以在网上投递
- Representatives of bidders normally attend and are asked to sign a register indicating their name and the firm they represent 投标人的代表应参加并代表公司签字
- Information to be Read Out: name of the bidder, total bid price, discounts offered, amount of bid security and any other information 开标时读出的资料：投标人名称，投标总价，折扣，投标保函金额和其他信息

7. Bid Evaluation 评标
Basics 基本介绍

Rejection of All Bids when 拒绝所有投标：

- Not substantially responsive 均无实质性响应
- Evidence of lack of competition exists 具有缺乏竞争性的证据
- All prices substantially exceed cost estimate 所有投标价格均相当大地超过了估算

Rebidding with new invitations, as consulted with ADB, when all bids rejected 拒绝所有投标时，在咨询亚行后进行重新招标：

- Examine reasons for failure to attract adequate number of responsive bids 检查未能吸引足够数量响应性投标的原因
- Revise Specifications, Scope of Supply, or bidding conditions as necessary 修改技术规范/规格，供货范围或必要的投标条件
- Re-advertise, or request new bids from those who submitted bids earlier or from all invited 重新刊登广告，或邀请先前递交标书的投标人重新投标，或邀请所有曾被邀请过的投标人重新投标

7. Bid Evaluation 评标
Basics 基本介绍

Clarification and modification of bids 标书的澄清与修改

- Only clarifications not changing the substance or the price of the bid may be requested or accepted by the Borrower (Single-Stage) 借款人只可以要求或接受不改动该标的实质或价格的澄清

Arithmetical Errors: No cause for bid rejection, and can be corrected 算数错误：不会造成拒标的可纠正

- Discrepancy between Unit Price and Total Price 单价与总价的差异
  - Unit Price will prevail 单价有效
- Discrepancy between Total Bid Amount and Sum of Total Prices 投标总价和各总价的合计的差异
  - Sum of Total Prices will prevail 各总价的合计有效
- Words vs. figures 文字表达与数字表达
  - Words prevail 文字表达有效

7. Bid Evaluation 评标
Basics 基本介绍

Commercial Aspects: Exercise flexibility in evaluating commercial aspects such as:

商务因素：检查评估商务因素的适应性，如：

- Delivery Schedule 供货计划
- Terms of Payment 支付条款
- Mode of Payments 支付方式

Duties and Taxes in Base Price for Comparison 评估中基本价格的关税问题

- for Goods from outside 进口货物 （到岸价）
  - Include cost of insurance and freight (CIF or CIP) 包括保险与运费
  - Exclude custom duties or other taxes levied on goods 不包括海关税或其他税项
- for Goods from inside 国内货物（出厂价）
  - Include ex-factory price (EXW)
  - Exclude any sales or similar taxes levied on finished goods 不包括对成品货物征收的任何销售税或类似税项

7. Bid Evaluation 评标
Basics 基本介绍

Compliance with Bid Documents 遵守招标文件

- Bids should be rejected if they: 拒标，如果：
  - Do not substantially conform to Specifications 未实质性遵守规格的要求
  - Contain inadmissible reservations to bid documents 包含不能允许的对招标文件的保留意见/限制
  - Do not substantially respond to requirements 未实质性响应招标文件的要求

Prompt Notification of ADB 迅速通知亚行

- EA should inform ADB early of unusual or difficult problems: 执行机构应将非正常情况或困难问题尽早通知亚行，比如：
  - Small number of bids received 只收到很少数量的投标书
  - High proportion of non-responsive bids 非响应性标书比例太高
  - All bid prices substantially higher than cost estimates 所有投标人的标价都相当大地高于估算

7. Bid Evaluation 评标
Evaluation Sequence 评标程序

1. Complete Basic Data Sheet 完成基本数据表
2. Prepare Record of Bid Opening 准备开标记录
3. Prepare Table of Bid Prices 招标投标报价表
4. Examine Bids for Responsiveness 响应性检查

选择进入详细评审的投标

5. Identify Bids for Detailed Evaluation

详细评标

6. Evaluate Bids in Detail

调整投标价

7. Adjust Bid Prices

其他调整

8. Apply Other Adjustments

7. Bid Evaluation 评标
Basics 基本介绍

Extension of Bid Validity 投标有效期的延长

- Considered in exceptional cases 只在特别情况下考虑
- When considered, all bidders should be asked 考虑延长时，所有的投标人都要被要求
- Bidders willing to extend bid validity 投标人愿意延长投标有效期
  - cannot modify substance of bid 不可改变投标的实质
  - must extend validity of bid security 必须延长投标保函有效期

No negotiation with Bidders, except 不可与投标人谈判，除非：

- with the Lowest Evaluated Bidder whose price still substantially exceeds cost estimate, 具最低评标价的投标人的价格仍然相当大地超过了估算
- considered only as last resort instead of rebidding, and after obtaining ADB approval 在获得亚行的批准之后，仅仅作为代替重新招标的最后的手段

Step 4 : Examine Responsiveness
第四步：响应性检查

Major Deviations 重大偏差

- Has an effect on the validity of the bid; or 对投标的有效性有影响
- Has been specified in the bid document as grounds for rejection; or 标书中规定的作为拒标的因素
- Deviation from the provisions of the bidding document with effect on the bid price, but cannot be given a monetary value; or 对投标价有影响，但无法计算出价格
- Deviation from the minimum experience qualifications specified in the bidding document; or 偏离标书中规定的最低经验要求
- Unacceptable deviation from the specifications 技术规范规定的不可接受的偏差
- Conditional bid 有条件投标

Step 3 : Prepare Table of Bid Prices
第三步：准备投标报价表

Table of Bid Prices

No.	Bidder's Name	Total Bid Price	Total Bid Price after arithmetic corrections	Total Bid Price in Local Currency
1	Bidder A	P5,200,000	P5,250,000	P5,250,000
2	Bidder B	$200,000 + P500,000	$200,000 + P600,000	P5,600,000
3	Bidder C	L150,000	L150,000	P5,700,000

Exchange rate used for comparison purposes: Official selling rates issued by the Central Bank on the date of opening of bids
US$1 = P 25
£1 = P 38

Step 4 : Examine Responsiveness
第四步：响应性检查

Minor Deviations 微小偏差

- Has no effect on the validity of the bid; or 对投标的有效性无影响
- Has no effect on the price, quality or delivery of the goods or services offered; or 对货物或提供的服务的价格，质量或方式无影响
- Has such effect, but the difference from commercial terms and technical specifications can be given a monetary value; or 有上面的影响，但与商务条款和技术规范的差异可以用金额表达
- Has not been specified in the bid document as grounds for rejection, provided total amount of deviations does not exceed a previously determined percentage of the bid price (usually 15 percent) 未在标书中规定的作为拒标的因素，但偏差的总金额未超过已确定的标价的百分比（通常 15%）

Step 4 : Examine Responsiveness
第四步：响应性检查

Purpose 目的

- Elimination of bids which are not responsive to important requirements of bidding documents 去除对标书文件中的重要要求无响应的投标

Examples 例子

- Failure to: 未能：
  - satisfy eligibility requirements 满足基本资格的要求
  - submit bid security 呈交投标保函
  - satisfy bidder's qualification criteria 满足投标人的资审条件
  - bid for required scope of work 对规定的工程范围进行投标
  - meet major technical requirements 满足主要技术要求
  - meet critical delivery schedule 满足关键的供货计划安排

Step 5 : Identify Bids to be Evaluated
第五步：选择进入详细评审的投标

Objective 目标

- To determine how many of the remaining substantially responsive bid should be evaluated in detail in order to identify the lowest evaluated bid 决定多少具有实质性响应的投标进入详细评审

Consideration 基本考量

- Detailed evaluation should include all substantially responsive bids that have the potential to become the lowest evaluated bid. 详细评审应包括所有可能成为最低评标价的实质性响应的投标
- No bid shall be excluded from the detailed evaluation if there exists a possibility that, as a result of various price adjustments, it could become the lowest evaluated bid. 如果存在通过调价会成为最低评标价的可能，所有投标都必须进入详细评审

Step 4 : Examine Responsiveness
第四步：响应性检查

Post qualification 资格后审

- Identifies qualified bidders during initial examination of opened bids 在对投标的初始检查中确定具有资格的投标人
- Spares borrowers/EA from detailed evaluation of bids of unqualified bidders 免去借款人/执行机构对无资格的投标人的投标进行详细评标

Typical Criteria 典型条件

- Experience 以往经验
- Financial position 财务状况
- Technical capability 技术能力
- Past performance 以往业绩

Step 7 : Financial Adjustments of Bids
调整投标价

Summary

	BIDDER "A"	BIDDER "B"
1. BID PRICE	31,403,725	33,973,305
2. ADJUSTMENTS :		
a. Scope of Supply	2,053,000	240,000
b. Technical Compliance	477,000	723,017
c. Performance	2,488,614	232,000
d. Terms of payment	340,000	105,000
e. Delivery	1,023,000	123,000
3. Total Evaluated Cost	37,785,339	35,396,322

Step 5 : Identify Bids to be Evaluated
第五步：选择进入详细评审的投标

- If there is no cluster of lower priced bids
  如果没有一组低标
  - Three lowest priced substantially responsive bids 则选择实质性响应的3家最低标
- If there is a cluster of lower priced bids
  如果有一组低标
  - All lower priced bids to be evaluated irrespective of number 则选择所有低标，无论多少

Step 8 : Other Adjustments
其它调整

Discounts 折扣

Application of discounts where bids are sub-divided into several bid packages 当标被划分成几个投标包时：

Least Cost Combination

Firm	Package 1	2	3	4	Disc.	Combinations
A	100	260			10%	A1+A2+B3+C4 = 1,024
B	140		300	450	0%	A1+D2+B3+C4 = 1,030
C	120	240	380	400	5%	C1+C2+C3+C4 = 1,083
D	180	230		500	20%	D1+D2+B3+D4 = 1,028

Step 6 : Detailed Evaluation of Bids
第六步：详细评标

Table of Salient Features

Part A: Commercial Features

ADB Loan No. :_____ Project Title:_____ Bid No. :_____

Specified Terms and Conditions	Provisions in Bid Docs	Bidder No. 1	Bidder No. 2	Bidder No. 3	etc.
Major commercial terms and conditions specified by Purchaser, such as: ▪ Delivery Date ▪ Terms of Payment ▪ O&M Costs ▪ Performance ▪ Productivity	Vol. No. Page No. Clause No.	Enter here, against each item status of compliance by each bidder			

Step 8 : Other Adjustments
其它调整

- Domestic Preference 国内优惠
  - Based on Per Capita GDP, reviewed by ADB annually 基于人均GDP，亚行每年审查公布
  - To provide margin of preference to domestically manufactured goods or domestic contractors for ADB-financed projects 对于国内生产的货物或者国内承包商提供优惠
  - To allow domestic firms to compete with foreign firms on more equal footing 允许国内公司与外国公司在更加平等的基础上竞争
- Conditions 条件
  - Granting of preference subject to condition 有条件地给予优惠
  - Applies only to ICB 仅适用于ICB
  - Subject to approval by government 须获得政府的批准
  - To be specified in Loan Agreement if scheme is applied 如果采用优惠方案应在贷款协议中说明

Step 6 : Detailed Evaluation of Bids
第六步：详细评标

Table of Salient Features

Part B: Technical Features

ADB Loan No. :_____ Project Title:_____ Bid No. :_____

Specified Terms and Conditions	Provisions in Bid Docs	Bidder No. 1	Bidder No. 2	Bidder No. 3	ETC.
Scope of supply and all key technical and performance requirements of major equipment, such as : ▪ Plant kW / Power ▪ Capacity / Speed ▪ Voltage / Pressure ▪ Fuel Consumption ▪ Efficiency ▪ etc..	Vol. No. Page No. Clause No.	Enter here, against each item corresponding features and technical/ performance data proposed by each bidders			

8. ADB's Review of Procurement
亚行对采购的审查程序

- Scheduling of Procurement 采购安排
- Prior Review 前审查
- Post Review 后审查

7. Bid Evaluation 评标
Recommendation for Award 授标建议

- Determine lowest evaluated substantially responsive bid 确定最低评标价格且具有实质性响应的投标
- Check whether the lowest evaluated substantially responsive bidder has the financial and technical capability (post qualification) 检查给投标人是否具有财务和技术能力 （资格后审）
- Recommend bidder for award of contract 推荐给投标人中标
- Prepare Bid Evaluation Report 准备评标报告
- Submit 3 copies of bid evaluation report to the Bank at least 30 days prior to expiration of bid validity 在投标有效期到期之前至少30天提交3份评标报告到亚行批准

8. ADB's Review of Procurement 采购审查
Prior Review 前审查

- **With Prequalification: 有资格预审的情况：**
  - Draft prequalification documents 资审文件草案
  - Evaluation Report 资审评比报告
- **Pre-bid stage: 招标前：**
  - Draft bidding documents 招标文件草案
  - Advertising procedures 广告程序
- **Post-bid stage: 招标后**
  - Bid evaluation report and recommendation of award
  - 评标报告和授标建议
- **Extension of bid validity required: 如果投标有效期需要延期：**
  - First request if longer than 4 weeks 第一次延期（如果多于4周）
  - All subsequent requests 以后的每次延期
- **After award of contract: 授予合同之后**
  - 3 copies of contract awarded 3份合同
  - The proposed changes 对合同的修改建议
  - Complaints from bidders 投标人的不同意见

7. Bid Evaluation 评标
Recommendation for Award 授标建议

Contents of Bid Evaluation Report 评标报告内容

- Basic Data Sheet 基本数据表
- Evidence of proper Advertising and Publication 刊登广告和出版物的证明
- Record of Bid Opening including Bidder's Attendance Sheet 开标记录
- Tables of Bidders and Bid Prices including corrections 投标人及投标价格表（含更正）
- Table of Substantive Responsiveness 实质响应性表
  - Commercial 商务
  - Technical 技术
- Detailed Evaluation of Bids 详细评标
  - Commercial 商务
  - Technical 技术
  - Table of bid price comparison 标价对比表
- Clarifications and other Attachments 澄清及其它附件
- Recommendation for Award of Contract 授标建议

8. ADB's Review of Procurement 采购审查
Post Review 后审查

- ADB's review no later than 6 months after receipt of the documents
  亚行的审查必须在收到文件后的6个月内完成
- Borrower shall retain all documentation in print form with signatures or stamps up to two years after project closing 借款人必须保留所有相关文件项目至结束后两年，打印的文件方式，具有相关的签字和印章
- If misprocurement is declared after disbursement, the borrower shall refund the corresponding amount to ADB 如果亚行在审查后宣布错误采购，但是已经进行的支付，借款人必须退回相关部分的金额给亚行

7. Bid Evaluation 评标
Publication of Award of Contract 公开授标情况

- Within two weeks of receiving ADB's no objection, the borrower shall publish in an English language newspaper or well-known and freely accessible website the results 在收到亚行不反对意见的两周内，借款人必须在英文报纸或者互联网上公布一下信息：
  - name of each bidder who submitted a bid; 每个递交了标书的投标人
  - bid prices as read out at bid opening; 在开标时读出的标价
  - name and evaluated prices of each bid that was evaluated; 参加评标的投标人的名字及评标价
  - name of bidders whose bids were rejected and the reasons for their rejection; and 被拒标的投标人的名字及原因
  - name of the winning bidder, and the price it offered, as well as the duration and summary scope of the contract awarded. 中标人名字，价格，工期和所授予的合同的概要
- For contracts subject to post review, the borrower shall publish the results no later than the date of contract award. 对于后审查的合同，借款人要在授标日期之前公布以上结果。

Summary: Highlights of the Guidelines

Innovation and Efficiency 创新性和效率性

- Require EAs to submit, prior to loan negotiation, a procurement plan detailing the contracts to be bid, methods of procurement and review procedures 要求执行机构在贷款谈判之前递交采购计划，明确将招标的合同，采购方法和审查程序
- Allow the use of electronic media for advertising, distributing documents, and receiving bids or prequalification applications 允许使用电子媒介来刊登广告，分发文件，接收招标或资审申请
- Clarify that bid securities are optional and other remedies such as the use of sanctions can be applied 明确投标保函是可选项，可以使用其它方式如罚款
- Introduce performance-based contracting, and deliverables are measured by functional outputs 引进依据成果的合同方式，依据最终成果的功能性产出来衡量
- Permit direct purchase from specialized agencies, where their expertise and purchase agreements offer advantages 允许向在专业技能和购买协议上具有优势的专业代理直接采购

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Summary: Highlights of the Guidelines

Streamlining 简化以提高效率

- Reduce the mandatory minimum periods for bidding and prequalification under ICB, from 60 to 42 days ICB的招标和资格预审的最低要求时间从60天减少到42天
- Deemphasize the standard use of prequalification - only for large or complex contracts 不再强调标准资格预审的使用，只用于大型或复杂的项目
- Encourage the use of advance procurement action 鼓励施行提前采购
- Clarify direct contracting as an acceptable method in special circumstances 明示在特殊情况下直接签订合同是可以接受的
- Provide borrowers the option to seek ADB review and approval after issued (such post review provisions agreed to during loan processing taking into account the capacity of the EA) 提供执行机构可选择在文件发出之后再经亚行审查和批准（须在贷款协议中写明，并考虑执行机构的能力）

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Thank You! 谢谢

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Summary: Highlights of the Guidelines

Harmonization 与其它MDB协调一直

- Introducing the term 'misprocurement', and changing LCB to 'national competitive bidding' and IS to 'limited international bidding' 引进 "采购失误" 的概念，LCB改称NCB，IS（国际采购）改称LIB（有限国际招标）
- Introduce new modes for commodity procurement and shopping 对日用品的采购引进新的方式
- Modify currency provisions (maximum of three currencies); remove specified values for bid securities; and align time periods and procedural requirements 修改货币条款（最多三种货币），去除投标保函的特定金额，调整时间周期和程序的要求使其协调一致
- Allowing the use of procurement agents and inspection agents 允许使用采购代理和监理代理
- Modify contract terms for performance securities and liquidated damages, and clarify price adjustment provisions 修改履约保函和违约金的合同条款，明确调价条款
- Eligibility: introduce conflict of interest as a cause for ineligibility, list eligibility conditions for government-owned entities, and make entities ineligible if subject to sanction by the UNSC 基本资格：引入利益冲突为取消资格的原因之一，规定政府所有的企业和资格条件，规定受到联合国安理会惩罚的企业将被取消资格
- Change the basis for domestic preference, from country classification to per capita GNP, and simplify the calculation 改变国内优惠的基本条件，采用人均GNP做基础，简化计算

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ADB PROJECT DISBURSEMENTS
亚行项目支付

GANSU BAIYIN URBAN DEVELOPMENT II PROJECT

甘肃白银城市发展二期项目

Summary: Highlights of the Guidelines

Transparency 透明性

- Extend coverage of the Guidelines to the contracts financed from grants and ADB-administered funds 扩大指南的适用范围，包括亚行赠款和亚行管理资金的项目
- Introduce a new appendix on guidance providing procedures for debriefing 引进新的附件以提供未中标者征询意见的程序
- Make dissemination of contract award information mandatory, and specifically require publication of the general procurement notice 公布授标信息为强制性行为，特别要求公布采购通知
- Emphasize greater use of websites and the internet to advertise and publish procurement-related information 强调使用网站和互联网来刊登广告和采购相关的信息

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I.3 Loan Documents 贷款文件

- The **loan agreement -** agreement between ADB and borrower and sets out the loan terms and conditions. 贷款协议-亚行与贷款人的协议，定出贷款条款
- **Guarantee agreement -** agreement between ADB and borrower as guarantor of the loan when ADB lends directly to a non-member entity. 担保协议-当亚行贷款给一个非成员国时，亚行与贷款人作为保证人的协议
- **Project agreement -** agreement between ADB and the project executing agency (EA) or implementing agency (IA) of the borrower specifying requirements related to physical implementation of the project, procurement, and financial aspects, including the maintenance of project financial statements and audit arrangements. 项目协议-亚行和贷款人的项目执行机构或实施机构的协议，定出有关项目的实施、采购、财务方面的要求，包括保存项目财务报表和审计的安排

I.1 Disbursement Policies 支付政策

- The ADB permits borrower to draw its loan funds only to meet expenditures in *connection with the project* as they are *actually incurred* 亚行允许贷款人支取的贷款，仅仅是为与项目有关的实际支付的开支
- Loan proceeds are *used only for the purposes for which the loan was granted* and with due attention to economy and efficiency of usage 贷款只可用于贷款批准的目标，使用上要注意经济和效益
- The borrower can withdraw loan funds *only after the loan agreement becomes effective*, unless retroactive financing is provided in the agreement 贷款人只可在贷款协议生效后支取贷款，除非协议上明确允许追溯贷款

I.4 Loan milestones (major event dates) 贷款里程碑（重要事件的日期）

- **Approval date -** the date the loan is approved by ADB Board. The date is used to determine the loan amortization schedule given as Schedule 2 in the agreement. 批准日期-亚行董事会批准贷款的日期，这日期用来确定在协议的第二条款的贷款偿还表
- **Signing date -** the date the loan agreement is signed by the borrower and ADB. For ordinary capital resources loans, *commitment charges will start to accrue* on the 60th day after the loan signing date. 签字日期-贷款人和亚行签署贷款协议的日期。对于一般资金来源贷款，在贷款签字日期的60天后会开始算承诺费

I.2 Important Definitions 重要的定义

- **Closing date** - the date ADB terminates borrower to make withdrawals from the loan account 关账的日期-亚行终止贷款人从贷款账户取款的日期
- **Disbursement** - the withdrawal of proceeds from the ADB-financed loan 支付-从亚行贷款提取资金
- **Eligible expenditures** - project expenditures that can be financed under the ADB loan 符合条件的开支-可按亚行贷款支付的项目开支
- **Expenditures incurred** - the borrower's obligation to pay after goods and services have been provided 发生的开支-贷款人在货物和服务提供了之后有责任支付的款项
- **Loan account** - the account opened by ADB on its books in the name of the borrower, and to which the loan amount will be credited 贷款账户-亚行以贷款人名义开的账户，贷款从其中支付

I.4 Loan milestones (major event dates) 贷款里程碑（重要事件的日期）

- **Effective date -** the date ADB advised the borrower that all conditions of loan agreement have been fulfilled by the borrower and disbursements may be made from the loan account. 生效日期-亚行告知贷款人，贷款人已经满足贷款协议的所有条款，并可以从贷款账目支付款项的日期
- **Project completion date -** the date on which the project is considered physically completed. This date is *normally 6 months before the loan closing date.* 项目竣工日期-项目实体竣工的日期，这日期通常是贷款结束日期前的6个月
- **Loan closing date** - the date ADB may terminate the right of the borrower to make withdrawals from the loan account. Expenditures incurred after the loan closing date *will not be financed* under the loan. 贷款关帐日期-亚行终止贷款人从贷款账目取款的日期。在贷款关帐日后所发生的开支不会得到融资

I.3 Loan Documents 贷款文件

- **Report and recommendation of the President** to the Board of Directors (RRP) - presents the project proposal for consideration by the ADB Board. 行长报告-给亚行董事会的项目建议
- P**roject administration manual** (PAM) - includes all information and schedules describing project implementation and project readiness covering pre-project implementation actions (e.g., government approvals, procurement, and resettlement) to *ensure a rapid start-up and enable early disbursement*. PAM is prepared during loan processing, and agreed with government at the loan fact-finding stage. At loan negotiations, the borrower and ADB review and confirm the PAM agreed during loan fact-finding to ensure consistency with the loan agreement. The detailed cost estimate by financier is presented in PAM. 项目行政手册-包括所有资料和附表，描述项目实施和项目准备情况，包括项目实施前的行动（例如，政府的审批、采购、移民安置），以确保尽快启动，尽早支付。在贷款谈判阶段，贷款人和亚行审查和确认在贷款实地考察期间所同意的项目行政手册，以确保与贷款协议一致。投资方的详细费用估算会在项目行政手册显示。

I.7 Loan cancellation 取消贷款

- ADB may also cancel any unwithdrawn amount of the loan when – 若有下列情况亚行可以取消贷款的任何未支取的金额
  - the borrower's right to make withdrawals from the loan has *been suspended for continuous 30 days*; 贷款人从贷款取款的权利已经连续30天被停止
  - ADB determines, after consultation with the borrower, that any amount of the loan will not be required for purposes of the project; 亚行在与贷款人咨询后，确定贷款的任何金额不需用在项目上
  - ADB determines that *corrupt or fraudulent practices* were engaged in by representatives of the borrower, or any beneficiary of the loan during the procurement of goods or services, consultants' selection, or the execution of the contract without the borrower having taken appropriate action to remedy the situation; 亚行确定，在货物或服务的采购过程中，以及在咨询专家选择的过程中，或在合同执行过程中，贷款人或贷款的任何受益者使用腐败的或欺诈的方法，而贷款人没有采取适当的行动去弥补该情况
  - ADB determines that the procurement of any goods and services to be financed out of the loan proceeds is inconsistent with the procedure set out in the loan agreement; 亚行确定贷款资金在任何货物或服务的采购中，与贷款协议定出的程序不一致，或
  - an amount of the *loan remains unwithdrawn* from the loan account by loan closing date. 在贷款结束日期时，在贷款账目仍然没有支取的金额

I.5 Retroactive financing 追溯贷款

- **Retroactive financing** - the financing of project expenditures incurred by the borrower *before a loan agreement becomes effective*. 追溯贷款-在贷款协议生效前贷款人所发生的项目开支的贷款
- ADB may approve, at the borrower's request, to finance expenditures incurred prior to loan effective date, but *generally no earlier than 12 months before signing the loan agreement,* except if justified in the RRP. 若贷款人要求，亚行可以批准支付在贷款生效日期前的开支，但一般不能早于贷款协议签署12月前，除非行长报告中提出理由
- Applies to eligible expenditures as agreed between ADB and the borrower. 适用于亚行和贷款人同意的符合条件的开支
- The amount to be retroactively financed does not exceed 20% of the loan amount. 追溯贷款的金额不超过贷款额的20%

I.8 Suspension of withdrawals 暂停支付

- ADB may suspend in whole or in part the borrower's right to withdraw from the loan account, if after the date of the loan agreement there is – 亚行可以全部或部分暂停贷款人从贷款账户支付的权利，如果在贷款协议日期后，有以下情况：
  - Non-payment of principal, interest, or any other charge; 没有支付本金、利息、或其他任何费用
  - Non-performance of any obligation under the loan, guarantee, or project agreements; 没有按贷款、担保、或项目协议承担任何责任
  - Non-fulfillment by the borrower, the guarantor, or the EA of certain conditions necessary for carrying out its project successfully; 贷款人、担保人、或执行机构，没有履行某些要成功进行项目所需的条款，
  - suspension or cessation of membership of the borrower; 贷款人的成员资格被暂停或终止
  - misrepresentations made by the borrower; 贷款人的失实的陈述
  - dissolution of the borrower or EA. 贷款人或执行机构的解散

I.6 Reallocation of loan proceeds 贷款资金的再分配

- Loan proceeds are used only for the purposes approved. No disbursements are made directly from the *"unallocated" category* of the loan agreement. 贷款仅只可用在批准的用途。不可直接从贷款协议的「未分配」类别取款
- ADB *may agree* to a borrower's request to reallocate funds from the "unallocated" or other categories to *another allowable category* for project purposes. 亚行可能同意贷款人请求将资金从「未分配」或其他类别，为了项目的目标而再分配到另一个允许的类别
- Normally the loan proceeds are reallocated after project progress has been reviewed with the borrower during review mission. 一般而言，在检查团与贷款人检讨过项目进展以后，贷款资金会再分配

I.9 Accelerating maturity 加快到期

- If certain events as indicated in the loan agreement, or in the Loan Regulations, occur for the period, ***ADB may declare as due and payable immediately*** the principal of the loan outstanding, together with all accrued interest and other charges. 如果在期间，贷款协议或在贷款条例表示的某些事件发生了，亚行可能宣告未还的本金，以致所有应支付的利息和其他费用，需要马上支付

I.7 Loan cancellation 取消贷款

- The borrower may, by notice to ADB, cancel any amount of the loan which has not been withdrawn. The effective cancellation date is when ADB receives the borrower's notice of such cancellation. 贷款人可以透过通知亚行取消未支取的贷款的任何部分。有效取消日期，是亚行收到贷款人通知取消的那天

II.3 Disbursement Guidelines 提款指南

- Disbursement percentage and financing percentage – 支付百分比和融资百分比
  - Disbursement percentage - the ratio of ADB financing which is applied to expenditure claimed under a particular expenditure category, as specified in the allocation table or other part of the loan agreement; 支付百分比-按分配所确定，或贷款协议的其他部分所确定，适用于某一个开支类别申报开支的亚行融资的比例
  - The disbursement percentage in the allocation table is derived from ADB's financing percentage as presented in the detailed cost estimate by financier provided in the PAM 分配表上的支付百分比，是从亚行的融资百分比计算出来，按项目管理手册规定的按融资方的详细费用估算

II.1 Disbursement Guidelines 提款指南

- General guideline - the borrower is responsible for implementing the project according to the loan agreement and other loan documents. ADB monitors the project and reviews progress to ensure that the *loan proceeds are spent as agreed upon*. 一般指南-贷款人负责按贷款协议和其他贷款文件实施项目。亚行监测项目，检查进展，以确保项目资金按协议提款

II.3 Disbursement Guidelines 提款指南

- Capitalized interest, Commitment Charges, Other fees 利息本金化、承诺费、其他费用
  - If the loan agreement provides for financing of interest, commitment charge, and/or other charges that may be charged by ADB *during construction or implementation*, ADB withdraws from the loan account and pays itself the amounts due. 如果贷款协议规定利息本金化、承诺费，及、或亚行在施工或实施期间收取的其他费用，亚行会从贷款账户提款，将费用支付给自己
  - If the loan agreement does not provide for financing these items, all charges are settled in cash as a part of loan service payment 如果贷款协议没有规定资助这些项目，所有费用会作为贷款偿还款以现金还清

II.1 Disbursement Guidelines 提款指南

- Actions to be undertaken by borrower – once loan is effective, 在贷款生效后贷款人要采取的行动
  - assign qualified accountants and establishes sound internal control and accounting systems in EA and IAs; 委任有资质的会计师，在执行机构和实施机构里设立健全的内部控制和会计制度
  - review Schedule 3 of the loan agreement which provides details of ADB financing such as amount, disbursement percentages, items of financing, and applicable conditions of financing; 检讨贷款协议的第3表，这里提供亚行贷款的细节，例如金额、支付比例、贷款项目、和贷款适用条件
  - maintain records for all signed contracts in a contract ledger for reference; 保存签署的所有合同在一个合同总账，以供参考
  - take proper actions for procurement in accordance with ADB guidelines 按亚行指南采取适当的采购行动

II.4 Disbursement Guidelines 提款指南

- Loan account closing – 贷款账户关账
  - Project completion date and loan closing date - **p**rojects are expected to be physically completed by the project completion date, which is normally 6 months before the loan closing date. 项目竣工日期和贷款关账日期-预料项目实体竣工的日期，通常是贷款关帐日期的6个月前
  - Final disbursement - preparation of WAs for final loan disbursement should be closely coordinated between ADB and the borrower and/or EA, particularly if the remaining unutilized balance is expected to be fully utilized. 最后支付-最后贷款支提款请的编制，应该由亚行和贷款人和、或执行机构紧密协调，特别是剩余的、没有使用的结余，是预算要全部使用完的

II.2 Disbursement Guidelines 提款指南

- Basic requirements to disburse – 支付的基本要求
  - ADB declared the loan effective; 亚行宣称贷款生效
  - the borrower submitted to ADB sufficient evidence of the authority of the person who will sign withdrawal applications (WAs) on behalf of the borrower, together with the authenticated specimen signature; 贷款人申报给亚行足够的证据，证明签字支付的人有权代表贷款人，连同核对过的印鉴签字
  - any subsequent change in the list of authorized representatives must be reported immediately, 授权代表名单的任何修改，要马上报告
  - and authenticated specimen signatures of new representatives must also be provided; and 需要提供新代表的核对过的印鉴签字
  - Appropriate conditions for withdrawal were met.已经满足提款的合适条件

III.1 Disbursement Instructions提款说明

- Authorized signatory –授权签字人
  - Withdrawal Application is signed by the borrower's duly authorized representatives. 提款申请应该由借款人正式授权的代表签署
  - ADB requires the borrower's representative to furnish sufficient evidence of the authority of the person(s) who will sign the WA, together with their *authenticated* specimen signatures. 亚行要求借款人代表提供授权签字人的充分证明，以及签字的样张
- Loan allocations –贷款分配
  - Items to be financed by ADB are grouped into cost categories. 亚行提供资助的项目需要放在成本类中
  - The loan agreement presents the amount allocated to each category of project expenditure (normally, this is presented in "Attachment to Schedule 3" of the loan agreement). 贷款协议注明项目支出每个类别的金额（一般证明在贷款协议的计划2 的附件中）
  - Reallocation from one category to another may be allowed unless prohibited in the loan agreement. 除非项目贷款不允许，从一个类别到另一个类别的调整时允许的。

III.2 Disbursement Instructions提款说明

- Withdrawal application – 提款申请
  - WA is signed by the borrower's duly authorized representatives; with sufficient evidence of the authority to sign the WA, together with *authenticated* specimen signatures. 提款申请由借款人的授权人签署，提供授权人的足够证明，以及提供签名样张
  - WA consists of – 提款申请包括
    - WA in letter form; 以信函形式的提款申请
    - summary sheets for each cost category claimed; and 申请报账各个类别的汇总表
    - supporting documents. 支持文件
  - Alterations on the WA must be initialed by the borrower's authorized representative. 提款申请的任何修改，需要授权签字人的小签
  - Minimum value per WA is US$100,000, unless otherwise approved by ADB. Borrower consolidates claims to meet this limit under reimbursement and imprest fund procedures. ADB reserves the right not to accept WAs below the minimum amount. 每份提款申请的最小金额是10万美金。借款人在报销和周转金的程序下汇总所有的报账以达到这个限额。亚行与权不接受低于最小限额的提款申请

III.3 Disbursement Instructions 提款说明

- Currency of payment – 支付的币种
  - Disbursement is made in the currency in which the cost of goods and services has been paid. 支付以货物和服务已经支付的货币支付
  - For expenditures incurred in the borrower's currency (local currency), the amount requested in WA must be in local currency. 在以借款人货币（当地货币）发生的支出，提款申请中要求的货币也必须是当地货币
  - A separate WA is required for each currency of disbursement. 对不同货币的提款，需要单独的提款申请
  - The amount paid is charged to the loan account, which is denominated in the loan currency. When the currency of payment is different from the loan currency, the amount paid is converted into the loan currency by ADB. 以当地货币支付的金额以计入贷款账号。当支付的货币与贷款协议不同时，亚行将把支付的金额转换为贷款货币

II.4 Disbursement Guidelines 提款指南

- Winding-up period – 扫尾期
  - the borrower may make withdrawals from the loan for expenditures incurred on or *before* the loan closing date.贷款人只可在贷款关账日期前，从贷款支取其开支
  - Expenditures incurred *after* the loan closing date *will not be financed under the loan*. 在贷款关账日期后所发生的开支，不能从贷款支付
  - ADB may allow up to 4 months after the loan closing date (i) for the borrower's WAs to be submitted to ADB for expenditures incurred on or before the loan closing date, and (ii) for the borrower to fully liquidate expenditures incurred on or before the loan closing date. 亚行允许在贷款关账日期4月后: (i)让贷款人在贷款关账日期前所发生开支的提款申请报给亚行，和（ii）让贷款人在贷款关账日前发生的开支全面结算
  - After the winding-up period, WAs, including requests for liquidation, will not be accepted. *Extension* of the winding-up period, on an *exceptional basis*, may be approved by ADB. Within 2 months after the winding-up period for submission of documents, the borrower should fully refund any outstanding imprest account balances to ADB. 在扫尾期之后，提款申请-包括结算的请求-不会被接纳。亚行在例外情况下可能批准延长扫尾期。在提交文件的扫尾期后的2月内，贷款人应该全部支付任何未支付专用账户给亚行

II.5 Disbursement Guidelines提款指南

- Refunds–退还金额
  - All refunds must be paid to ADB's accounts at its depository banks with payment details.所有的退款必须退还给亚行的开户银行账户上，同时注明支付细节
  - If funds withdrawn from the loan account are determined to be in excess or ineligible for ADB financing, the borrower must arrange a refund as instructed by ADB.假如从亚行提取的资金过度或者不合格，贷款人则被亚行指示必须安排退款
  - For closed loans, ADB may apply the amount refunded to debt service (e.g., interest or principal) if the amount of refund is small.对已关闭账户的贷款。如果退还的金额较小，亚行就会将其用作还本或者支付付息。
- Retention money and bank guarantee –保留金和银行担保
  - Payments of retention money under civil works and supply contracts are made at the end of warranty or after the issuance of a performance certificate by the employer and/or buyer. 土建和货物合同的保留金在保质期结束以后，或者业主签发运行证明以后退还
  - Where payment of retention money is due more than 4 months past the loan closing date, ADB may disburse the retention money to the contractor or supplier against an unconditional bank guarantee of equivalent amount provided by the contractor or supplier to the EA. 如果保留金在贷款关帐4个月后仍未退还，亚行将根据承包商或者供货商向执行机构提交的无条件保函的数额支付给承包商和供货商。

II.6 Disbursement Guidelines提款指南

- Audited financial statements –已审核的财务报告
  - Borrower must submit annual audited project financial statements (AFS) during project implementation. 在项目实施期，借款人必须提交年度审计的财务报表
  - Borrowers are required to submit AFS within 6 months after the close of the fiscal year to sector division or resident mission for their review and necessary action. 借款人必须在每个财年结束后6个月内提交年度审计错误报表给亚行的相关处室和代表处
  - In accordance with ADB's Public Communications Policy, AFS for sovereign projects need to be posted on the ADB website. 根据亚行的公共通讯政策，年度审计错误报表需要在亚行网站上公布
- Retention period of supporting documents –证明文件的保存期
  - The borrower is required to retain all records (e.g., contracts, purchase orders, invoices, bills, receipts, sub-loan agreements) evidencing eligible expenditures and to enable ADB's representative to examine such records. 借款人要求保存所有能够证明可以支付的记录（例如：合同，订购单，请款单，货单，发票，分贷款协议），以便亚行的代表检查
  - Such records should be *retained for at least 1 year* following receipt by ADB of the final AFS or *2 years after the loan closing date*, whichever is later. Borrowers are responsible for ensuring that document retention also complies with their government's laws and regulations. 这样的记录至少应该保存：亚行收到年度审计财务报表后的一年，或者是贷款关帐后两年，哪一个时间在后为准。借款人还应该负责文件的保留将符合政府的法律法规。

Approval authority批准机关	Procedures批准程序	Full/Simple documentation完整\简易的证明文件	Key supporting documents重点证实文件
No need for ADB approval不需要亚行批准	Direct payment直接支付	Full supporting documents 完全的文件支持	Invoice发票
	Commitment 承诺		Contract, LC 合同，信用证
	Reimbursement WITH full supporting docs 需要完全文件支持的报销		Invoice, proof of payment发票，支付证明
	Commitment 承诺		
Need for ADB approval需要亚行批准	Reimbursement WITHOUT full supporting docs 不需要完全文件支持的报销	Force account 自营工程	Financial progress certificate 财务监督证明
		SOE 国企	SOE
	Imprest fund 周转金	Force account 自营工程	Physical, financial progress certificate 实际，财务监督证明
		SOE 国企	SOE 国企
		Full supporting documents 完全文件支持	Invoice, proof of payment发票，支付证明

IV.1 Disbursement Procedures 提款程序

- 4 Major Types 主要的种类
  - **direct payment procedure** - ADB, at borrower's request, pays a designated beneficiary directly; 直接支付-根据借款人的请求，直接向指定的受益人支付
  - **commitment procedure** – ADB reimburses a commercial bank for payments to a supplier against a letter of credit (LC) financed from the loan account; 承诺-亚行通过商业银行向供货商支付，根据贷款账户承担的信用证
  - **reimbursement procedure** - ADB pays from the loan account to the borrower's account for eligible expenditures paid for by the project out of its budget allocation, or its own resources; and 报销-亚行从贷款账户中支付合格的费用，根据预算分配或者其自己的资金
  - **imprest fund procedure** - ADB makes an advance disbursement from the loan account for deposit to an imprest account to be used exclusively for ADB's share of eligible expenditures. 周转金-亚行从贷款账户中预付资金至周转金账户，仅仅用于亚行需要支付的支出

Project Performance Management System

亚行项目绩效管理体系

设计与监测框架

Design and Monitoring Framework

PPMS

IV.2 Disbursement Procedures支付过程

- Disbursement procedures and types of payment –支付程序和付款方式

Disbursement Procedures 支付程序	Types of payments付款方式
Direct payment直接支付	Large civil works, progress payments, consultants' fees, procurement of goods 大型土建，进度款，咨询费
Commitment承诺函程序	Importation costs 重要的费用
Reimbursement 报销	Local currency cost, small purchases, small civil works 当地货币的费用，小型采购，小型土建
Imprest fund 周转金	Contractors' and suppliers' bills in local currency, operating expenses, small expenditures 承包商和供货商用当地货币支付的账单，运行费用和小额支出

议 程 安 排

Agenda

- 介绍设计与监测框架用途和重要性
  Presentation on importance and usage of DMF √
- 介绍项目要解决的问题和初步设定的内容
  Presentation on Problem Tree / Objective Tree
- 共同完成设计与监测框架的制定
  Prepare DMF with all participants
- 下一步在设计和检测框架方面的工作
  What to do next on DMF/PPMS

PPMS

IV.3 Disbursement Procedures支付程序

- Inter-relationships of types of procedures程序类型的互动关系 –

观念的转变
Shift of Focus

从着眼于**内部活动和财务投入**的管理转向着重于**发展结果的实现**

Moves the focus of an internal activity orientation's and financial inputs towards the achievement of development results

PPMS

简介
Introduction

- **发展结果导向管理**
  Management for Development Results (MfDR)
- **项目绩效管理体系**
  Project Performance Management System (PPMS)
- **设计与监测框架**
  Design and Monitoring Framework (DMF)

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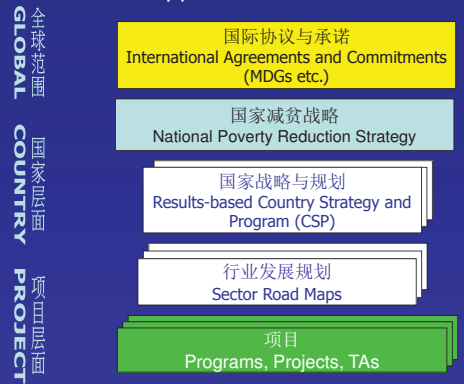
发展结果导向管理的应用
Application of MfDR



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发展结果导向管理
Management for Development Results (MfDR)

PPMS

项目绩效管理体系
Project Performance Management System (PPMS)

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什么是发展结果导向管理
What is Management for Development Results (MfDR)?

发展结果导向管理是一种管理方法

Management for Development Results is a management approach:

- 基于清晰的目的和目标
  built on clarity of goals and objectives
- 提供能量度和监测绩效和结果的体系
  provides systems for measuring & monitoring performance and results
- 确保利益相关方在发展过程中的全过程参与
  assures beneficiary participation at all stages of the development process
- 联系着结果和计划以及资源分配
  links results with planning and resource allocation
- 着重于绩效和结果两方面
  focuses on both performance and achievement of results

PPMS

有效的项目绩效管理体系
How to Make PPMS Works

- 政府领导层的支持
Government's leadership support
- 激励机制和惩罚措施
Incentives for good performance and sanctions for poor performance
- 报告机制
Verification of reporting systems in place
- 使用体系的人员的能力
Staff capacity to use the system
- 基准数据
Baseline information in place
- 监测的独立性
Independent monitoring

PPMS

项目绩效管理体系
What is PPMS?

项目绩效管理体系是发展结果导向管理在项目层面上的应用，为项目提供了一个在项目生命周期各阶段共同的评价框架

Project Performance Management System is the application of MfDR at project/program level, providing a common evaluative framework covering all stages of the project life cycle.

PPMS

设计与监测框架
Design and Monitoring Framework (DMF)

PPMS

项目绩效管理体系的组成
Components of PPMS

项目绩效管理体系包含五个元素
PPMS consists five elements:

- 项目设计与监测框架
Project design and monitoring framework (DMF) √
- 项目绩效报告
Project performance report (PPR)
- 项目完工报告
Project completion report (PCR)
- 项目后评价报告
Project performance audit (post-evaluation) report (PPAR)
- 借款人/项目执行机构的监测和评价
Borrower/EA monitoring & evaluation

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设计与监测框架
What is DMF?

- **形式上是一包含垂直方向和水平方向两个方向逻辑关系的表格**
A table inbuilt with vertical and horizontal logic
- **内容上是一工具，包含项目设计文件和第一手数据源**
A tool integrated with design documents and the primary sources used during implementation, evaluation, and post-evaluation

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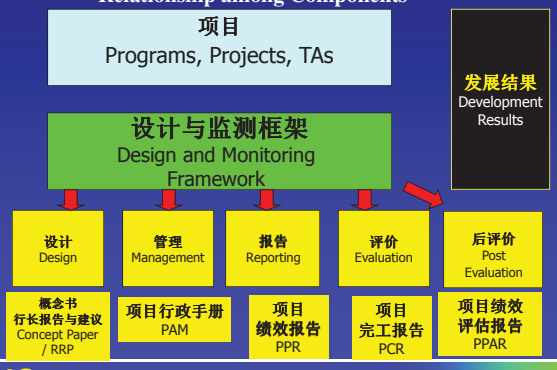
元素间的关系
Relationship among Components



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设计与监测框架的实践
DMF in Practice

设计与监测框架的编制伴随着整个项目准备过程
Preparing DMF is a process through all PPTA stages

- 利益相关方分析应该在项目准备技援一开始进行
  Stakeholder Analysis should be conducted at the start of PPTA inception
- 问题分析和目标分析贯穿着项目准备技援实施全过程
  Problem Analysis and Objective Analysis should be integrated in the process of PPTA implementation
- 完成设计与监测框架应由主要利益相关方在项目准备技援结束前完成√
  Completing DMF should be conducted with key stakeholders in the form of a workshop before the end of PPTA.
- 检查和修改设计与监测框架直到项目实地考察结束
  Review and revise DMF until the end of loan fact-finding

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DMF 表格
DMF Table

设计概要 Design Summary	绩效目标与指标 Perform. Targets	数据来源 Data Sources	假设与风险 Assumptions & Risks
影响 IMPACT			假设与风险 A & R
成果 OUTCOME			假设与风险 A & R
产出 OUTPUT			假设与风险 A & R
活动与阶段性目标 ACTIVITIES & MILESTONES			投入 INPUTS

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完成设计与监测框架
Completing Design and Monitoring Framework (DMF)

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DMF 方法
DMF Approach

设计与监测框架
Design and Monitoring Framework

设计 Design
替代选择分析 Alternatives
目标分析 Objectives
问题分析 Problem analysis
利益相关方分析 Stakeholder analysis

设计概要 Design Summary	绩效目标与指标 Perform. Targets	数据来源 Data Sources	假设与风险 Assumptions & Risks
影响 IMPACT			假设与风险 A & R
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产出 OUTPUT			假设与风险 A & R
活动与阶段性目标 ACTIVITIES & MILESTONES			投入 INPUTS

PPMS

完成设计与监测框架的过程
Process of Completing the DMF

第一步：完成设计概要各组成部分的表述，包括从目标树转移过来的成果、影响、产出、活动、投入
Step 1: Complete statement of every element of Design Summary including Outcome, Impact, Outputs, Activities, and Inputs, transferred from the Objective Tree

第二步：决定绩效目标与指标，以及数据的来源
Step 2: Determine performance targets and indicators, and data sources for outcomes, impact, and outputs

第三步：分析项目潜在的假设与风险
Step 3: Determine underlying assumptions and risks for all levels of the design summary, starting with activities to outputs

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制定设计与监测框架的过程
DMF Design Process

形势分析 Situation Analysis
↓
利益相关方分析 Stakeholder Analysis
问题分析 Problem Analysis
↓
项目选定 Project Identification
↓
目标分析 Objectives Analysis
↓
替代方案选择分析 Alternatives Analysis
↓
设计与监测框架 Design and Monitoring Framework

PPMS

设计概要
Design Summary

影响
IMPACT

成果
OUTCOME

产出
OUTPUTS

活动
ACTIVITIES

第一步：项目成果
1st Step – Outcome

为什么要做这个项目
Why do you want to do the project?
项目要解决什么样的发展问题
What is the problem or constraint you hope to resolve ?
成果的表述决定了项目的性质和范围
Outcome statement determines the nature and scope of the project.

项目成果的表述形式
Style of Outcome Statement
旅行巴士公司提供安全，可靠的公共交通服务
Safari Bus Company provides safe and reliable public transport services.
（是一个变化的表述，而不是对行动的表述）
change statement, not an action statement

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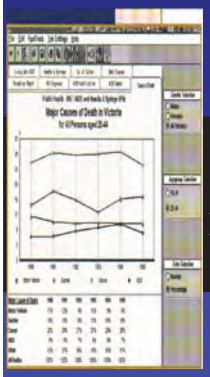

设计概要
Design Summary

PPMS

设计概要
Design Summary

影响
IMPACT

成果
OUTCOME

产出
OUTPUTS

活动
ACTIVITIES

第二步：影响
2nd Step – IMPACT

项目实施在中长期将对行业、地区、国家层面上产生的影响
The high level objective to which the project is intended to contribute, a long term effect at sector, national level

项目影响的表述形式
Style of Impact Statement
阿鲁沙市交通体系运行良好
The transport system of Arusha is functioning well.

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完成设计概要的表述
Statement of Design Summary

第一步：从成果开始，即阐明项目要完成的目标
Step 1: Start from outcome statement i.e. what the project intends to accomplish

第二步：阐明项目将带来的影响
Step 2: Clarify the intended impact i.e. what the project will contribute

第三步：决定完成项目目标所必需的产出
Step 3: Decide which outputs are necessary to achieve the outcome

第四步：决定实现产出必需的主要活动
Step 4: Determine key activities necessary to produce the outputs

第五步：列出开展活动所需的主要资源
Step 5: List inputs required to carry out the activities by source

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设计概要
Design Summary

影响
IMPACT

成果
OUTCOME

产出
OUTPUTS

活动
ACTIVITIES

第三步：产出
3rd Step – Outputs

项目具体产生和提供的实物、产品、和服务是什么？
What, specifically, will the project produce, provide or leave behind?
如：基础设施，新的政策和程序，机构建设的加强，人员能力的提高
e.g. Infrastructure, New Policies & Procedures, Strengthened Institutions, Skilled Personnel

产出表述的例子
Examples of Output Statement

1. **巴士车队维护良好**
Bus fleet is well maintained.

2. **司机遵守交通安全法规**
Drivers observe safety and traffic regulations.

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垂直逻辑
Vertical Logic

当问题分析，目标分析，和选择替代方案分析完成后，我们就可以完成设计概要
With problem analysis, objectives analysis and alternatives completed, now we are able to complete the Design Summary.

设计概要 Design Summary	绩效目标与指标 Perform. Targets	数据来源 Data Sources	假设与风险 Assumptions & Risks
影响 IMPACT			假设与风险 A & R
成果 OUTCOME			假设与风险 A & R
产出 OUTPUT			假设与风险 A & R
活动与阶段性目标 ACTIVITIES & MILESTONES			投入 INPUTS

PPMS

绩效指标与目标

Indicators/Targets

设计概要 Design Summary	绩效指标与目标 Performance Indicators/Targets	数据来源 Data Sources	假设与风险 Assumptions/ Risks
影响 IMPACT			
成果 OUTCOME			
产出 OUTPUTS			
活动 ACTIVITIES			

指标：是指用什么来衡量

Indicators outline what will be measured

目标：明确了相应的时间和数量

Targets specify quantity and time (how much by when)

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第四步：活动

4th Step – Activities

设计概要 Design Summary

影响 IMPACT

成果 OUTCOME

产出 OUTPUTS

活动 ACTIVITIES

项目具体将会做些什么事？

What, specifically, is the project GOING TO DO?

如：建….培训….安装… 这些行动的表述

For example: 'Build…', 'Train…', 'Equip…' all action statements

活动表述的例子

Sample Activities

产出 1：巴士车队维护良好

Output 1. Bus fleet is well maintained.

1.1 建立巴士养护时间表，并遵照执行

Establish and follow the bus maintenance schedule.

1.2 购买配件

Procure spare parts.

1.3 提高巴士机修工的技能

Upgrade skills of bus mechanics.

产出 2：司机遵守交通安全法规

Output 2. Drivers observe safety and traffic regulations.

2.1 引入国家巴士司机驾照和考试制度

Introduce a national bus driver license and examination system.

2.2 引入安全驾驶激励机制

Introduce incentives for safe driving.

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对指标的实用提示

TIPS

指标应当实用

Indicators need to be practical:

- 指标必须是可衡量的

  Indicators have to be measurable in terms of either quality or quantity, and time.
- 仅衡量重要事宜

  Measure only what is important
- 指标数量要适宜

  Limit the number of indicators to the minimum necessary to measure the respective result level
- 确保衡量指标的方法是经济的

  Ensure that the means of measuring is cost-effective

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第五步：投入

5th Step – Inputs

设计概要 Design Summary

影响 IMPACT

成果 OUTCOME

产出 OUTPUTS

活动 ACTIVITIES

INPUTS

开展活动需要哪些主要资源，包括资金、设备、材料，和人员？

What RESOURCES does the project need to do its work? Including Funding, Equipment, Material, and Personnel

亚行－1500万	**ADB** – $15 million
咨询服务－125万	Consulting services – $1.25 million
土木工程－200万	Civil works – $2 million
设备－800万	Equipment – $8 million
不可预见费－375万	Contingencies – $3.75 million
政府－500万	**Government** – $5 million
人员－200万	Personnel – $2 million
交通与物流－150万	Transport & logistics – $1.5 million
运营费用－150万	Operating expenses – $1.5 million

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怎样开始指标的选定

How to start….

- **项目执行机构现有哪些指标？**

What is available now with the EA?

- **过去用过哪些指标去衡量类似的问题？**

What did we use to confirm problems?

- **其他机构所用的相关的指标**

What other agencies may have relevant indicators or data?

- **亚行专家的意见**

ADB expertise

- **明确**

Specific – precise and unambiguous

- **可衡量**

Measurable – reliable and verifiable

- **可实现**

Achievable – realistic

- **相关性**

Relevant - sufficient to assess performance

- **时限**

Time bound – allows effective management action

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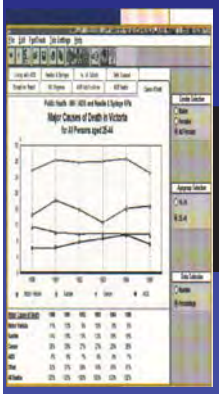

绩效指标与目标

Performance Indicators & Targets

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确定绩效指标和目标的步骤（二）
Step-by-Step, continued

4. 添加时限

Add the time frame

如：从项目实施的第4年开始，每年

per annum starting in year 4 of project implementation

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易于管理的指标
Management-friendly Indicators

- 领先或过程指标– 监测中期目标

Leading or Process Indicators – intermediate performance targets to monitor progress

例如：监测高等教育普及率的提高，通过（1）辍学率降低（2）入学率提高

e.g. measure increased higher education attainment by (i) % reduction of drop-out rate p.a., (ii) % increased enrollment rate p.a.

- 代理指标– 当有些指标不实际时

Proxy Indicators – used when specific indicators are not practical

例如：监测农村收入的提高，通过（1）混凝土房屋增加 （2）摩托车增加

e.g. measure increased rural income by (i) % increase of concrete buildings, (ii) % increase of motorcycles

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指标与目标的实例
Indicator/Target

从项目实施的第4年开始，每年通过国家标准化考试的毕业生的数量增加1万到1.5万人

The number of graduates passing national standard examination increases by 10,000 to 15,000 per annum starting in year 4 of project implementation.

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怎样描述目标
How to State Targets

- **定性**

Quantity

- **定量**

Quality

- **费用**

Cost

- **时间**

Time

- **顾客或社区满意度**

Customer/Community satisfaction

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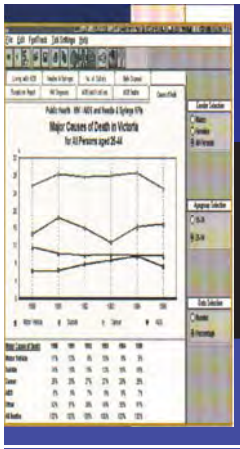

数据来源和报告机制
Data Sources / Reporting Mechanisms

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确定绩效指标和目标的步骤（一）
Step-by-Step

1. 确定衡量什么，即指标

Determine what to be measured

如：更多受到更好教育的学生毕业

More and better educated students graduate.

2. 确定数量

Decide on the quantity

如：毕业生数量增加1万到1.5万

The number of graduates increases by 10,000 to 15,000

3. 描述性质

Describe the quality

如：通过国家标准化考试的毕业生数

The number of graduates passing national standard examination

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数据来源的实例
An Example: Data Sources

设计概要 Design Summary	绩效指标与目标 Performance Targets / Indicators	数据来源与报告机制 Data Sources/ Reporting Mechanisms
影响 阿鲁沙市交通系统运行良好 Impact The transport system of Arusha is functioning well.	到2008年，使用公共和私家交通横穿阿鲁沙市所需时间减少25% The time to cross Arusha by public and private transport is reduced by 25% by the year 2008.	市交通控制中心的年度交通调查报告 Annual traffic investigation reports of the City Council Traffic Control Center

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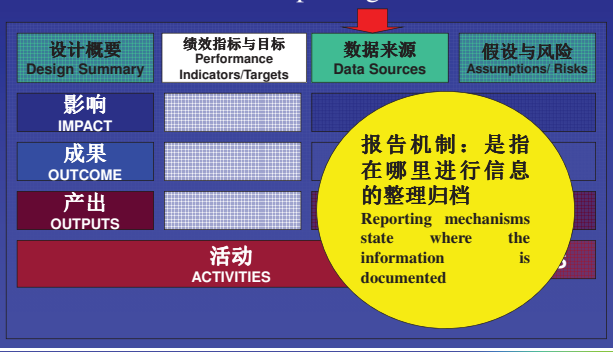
数据来源/报告机制
Data Sources / Reporting Mechanisms



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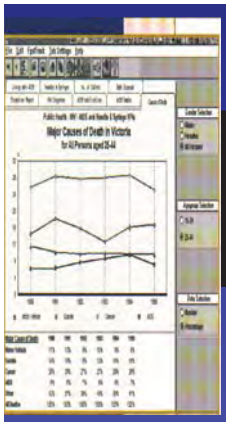

假 设 与 风 险
Assumptions and Risks

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数据来源
Data Sources

- **在哪里得到每项指标的信息（二级数据）？**
  Where can information on the status of each indicator be obtained (secondary data)?
- **谁来提供这些信息？**
  Who provides the information?
- **如何收集相关信息，如现场调查（一级数据）？**
  How is the information collected (primary data), i.e. field observations?

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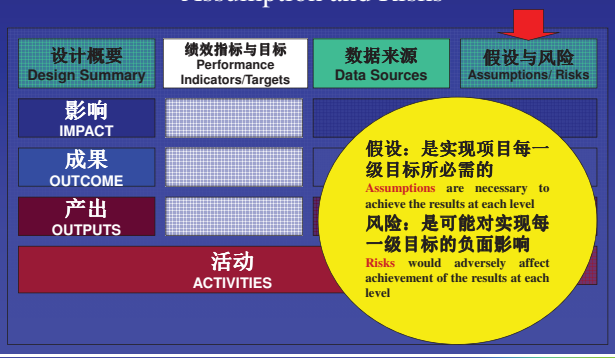
假设与风险
Assumption and Risks



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确定数据来源的步骤
Step-by-Step

1. 检查现有信息系统的有关信息，评估数据的可用性
   Review existing information systems relevant for the project and assess credibility, and timely availability of the data.
2. 制备一二级数据来源的详细目录，如，物价指数
   Do an inventory of **secondary sources**—data that are collected and published regularly, e.g. consumer price index, export statistics, national account information, school enrollment figures.
3. 考虑一级数据收集的必要性；若必要，是否有能力收集
   If it is necessary to collect primary data, check if EA is willing, and has the capacity to collect primary data. *(Include in project design)*

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假设与风险的范畴
Areas of risks and assumptions

- 金融和经济风险
Financial and economic risks
- 环境风险
Environmental risks
- 政治风险
Political risks
- 运营风险
Operational risks
- 技术风险
Technical risks
- 安全风险
Security risks
- 社会风险
Social risks

假设一般在
Assumptions on:
- 市场条件/价格
Market conditions/prices
- 宏观经济/条件
Macroeconomic policies/conditions
- 政治和社会条件
Political and social conditions
- 行业政策和条件
Sector policies and conditions
- 环境条件
Environmental conditions
- 私营部门的能力
Private sector capability
- 政府管理能力
Government administrative capability
- 社区/非政府的配套资金
Community/NGO support counterpart funding

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假设
Assumptions

项目成功实施所必需的外界环境，但不在项目控制范围之内
An external condition which is essential to the project's success but beyond its control

假设：良好道路网的建设
Example: Good Road Network

如项目范围只包括1&3，就需假设2的存在
Need to make assumptions

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假设与风险分析的步骤
Step-by-Step

1. 假设/风险是否不在项目控制范围之内
Is the assumption/risk external (out of the control of the project)?
是 Yes — *不是 No (不考虑 don't include)*

2. 假设很重要吗？风险很高吗？
Is the assumption important? risk high?
是 Yes — *不是 No (不考虑 don't include)*

3. 风险可能会发生吗？
How likely is the risk to become reality?
会 Almost certain (重新考虑项目设计 redesign)
可能会 Somewhat likely (管理风险 include)
不会 Unlikely (不考虑 don't include)

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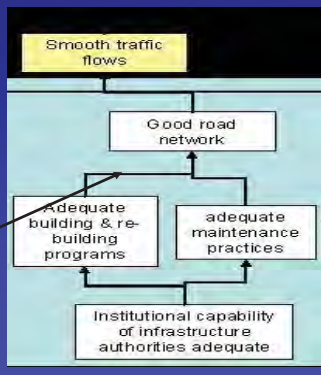
风险
Risks

可能发生，并对实现期望结果产生负面影响的情况、事件、或行动

What is most likely to go wrong and would adversely affect to achieve the intended results?

例如：配套资金的来源不足
Example: Lack of availability of counterpart funding



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假设与风险分析
Assumption/Risk Matrix

假设：重要性 A: Criticality/Importance
风险：可能性 R: Likelihood

	低 L	中 M	高 H
高 H	规避 Monitor-consider Mitigating	规避并制定应急计划 Mitigate - Prepare Plan	项目杀手：重新考虑项目 Killer: Rethink Project
中 M	监测 Monitor	规避 Monitor – consider Mitigating	规避并制定应急计划 Mitigate – Prepare Plan
低 L	忽视 Ignore	监测 Monitor	规避 Monitor – consider Mitigating

假设：失败概率 A: Probability of Failure
风险：期望影响 R: Expected Impact

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水平逻辑
Horizontal Logic

设计与监测框架
Design and Monitoring Framework

设计 Design
替代选择分析 Alternatives
目标分析 Objectives
问题分析 Problem analysis
利益相关方分析 Stakeholder analysis

设计概要 Design Summary		假设与风险 Assumptions & Risks
影响 IMPACT		假设与风险 A & R
成果 OUTCOME		假设与风险 A & R
产出 OUTPUT		假设与风险 A & R
活动与阶段性目标 ACTIVITIES & MILESTONES		投入 INPUTS

假设为真，风险并未成为事实的情况下
As hold true & Rs do not eventuate

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感谢您的参与！

Thank you for your participation!

GOOD LUCK!

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风险管理

Responses to Risks and Assumptions

- 忽视

Avoidance
  - 不考虑对项目的影响

  Eliminate the cause of the threat
- 规避

Mitigation
  - 采取防范措施

  Take preventive measures – to reduce likelihood of occurrence or impact if it does
- 接受

Acceptance
  - 接受其造成的结果

  Accept consequences and/or
  - 制定应急方案

  Develop a contingency plan

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中水回用

- 中水回用概况
- 回用水水质标准
- 中水回用系统
- 中水回用处理技术方法
- 中水回用安全措施
- 中水回用工程实例

对假设和风险分析的实用提示

TIPS

- 少量而相关

Few, but relevant
- 项目控制范围外的

External to the project
- 确保对应正确的层级

Need to ensure they are placed in the right level – specific and unique to a particular level
- 怎样去监测它们

How to monitor them – how will you know if things change?
- 项目利益相关人的作用

Active role of Stakeholders in identification and monitoring

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一、中水回用概况

- 由于水污染，造成了很多的城市水质型缺水或水量型缺水。据统计，全国669个城市中，400多个城市常年供水不足，其中有110个城市严重缺水， 日缺水量1600万m^3 。由于缺水现象的存在，加之城市污水的特点，可以说，中水将成为城市第二水资源。

假设与风险的实例

An Example: Assumptions/Risks

设计概要 Design Summary	绩效指标与目标 Performance Targets/Indicators	数据来源与报告机制 Data Sources / Reporting Mechanisms	假设和风险 Assumptions and Risks
影响 阿鲁沙市交通系统运行良好 Impact The transport system of Arusha is functioning well	到2008年，使用公共和私家交通横穿阿鲁沙市所需时间减少25% The time to cross Arusha by public and private transport is reduced by 25% by the year 2008.	市交通控制中心的年度交通调察报告 Annual traffic investigation reports of the City Council Traffic Control Center.	假设：市议会有关让旅行巴士公司提供公共交通服务的政策不变 A: The City Council's policy regarding the provision of public transport services by SBC remains unchanged.

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污水处理厂的出水：水质好流量稳定，可以用于工业冷却水、城市的绿化、洗车等多项用水。

1、中水的概念

- 中水（再生水）是指将人们在生活和生产中使用过的水，经集流再生处理后，回用充当地面清洁、浇花、洗车、空调冷却、冲洗便器、消防、景观等不与人体直接接触的杂用水。

4、中水的用途

- 园林绿化用水。园林绿化用水主要包括4个方面，即绿化用水、河湖补水、景观用水、公园内冲洗厕所用水、公园内道路冲洗用水等。
- 中水用于小区。将中水引入小区，实现双路供水是建设节水型城市的重要体现，小区中的冲厕用水、绿化用水、洗车等方面都可以用中水代替。如天津市梅江小区就将中水管线直接介入用户的马桶内用于冲厕，既避免了居民误饮误用，又使得管理收费方便易行。

2、中水回用的特点

- 中水回用能减轻污水治理工程的投资规模、处理负荷，对实施中水回用者有利，另外，它还能促进区域水资源的有效利用。
- 中水回用不得影响卫生方面，在利用时不得有嗅觉和视觉上的不快感，对管道、卫生设备等不能产生腐蚀和堵塞等影响，并要求有稳定、可靠的水处理技术，同时，要建立相应的考核指标，便于监督、管理和监测，在维持必要的水质条件下，处理成本要求经济、合理等。
- 中水的水质必须符合一定的水质标准

- 中水洗车。中水在水质、水量上都能满足洗车的要求，并具有以下优势：第一，节约用水；第二，中水水价一定比现行洗车水价低廉，各用户容易接受推广起来比较容易；第三，水量丰富，可以节省循环设备的投资，用于引进先进洗车设备，提高工作效率。
- 工业冷却水。工业冷却水用量大，且不受季节影响，中水回用工程在规划阶段应充分考虑工业用户。

3、工业区可利用的中水水源

雨水：水质较好，是一个重要水资源，根据建筑物形状和规模，可设置利用雨水的中水系统。但是，水量受到自然条件的限制。例如，东京大卵多功能体育馆建有雨水利用型中水系统，从穹形薄膜屋顶收集雨水到贮存池，在经过滤后进入中水回用系统。雨水贮存池还供应消防用水，利用雨水使年用水量降低 ；

二、回用水水质标准及规范

1、回用水水质基本要求

为达到污水回用安全可靠，回用水水质应满足以下基本要求：

(1) 回用水的水质符合回用对象的水质控制指标；

(2) 回用系统运行可靠，水质水量稳定；

(3) 对人体健康、环境质量、生态保护不产生不良影响；

(4) 回用于生产目的时，对产品质量无不良影响；

(5) 对使用的管道、设备等不产生腐蚀、堵塞、结垢等损害；

(6) 使用时没有嗅觉和视觉上的不快感。

城市污水再生利用类别 （GB/T 18919-2002）

序号	分类	范围	示例
1	农、林、牧、渔业用水	农田灌溉	种籽与育种、粮食与饲料作物、经济作物
		造林育苗	种籽、苗木、苗圃、观赏植物
		畜牧养殖	畜牧、家畜、家禽
		水产养殖	淡水养殖
2	城市杂用水	城市绿化	公共绿地、住宅小区绿化
		冲厕	厕所便器冲洗
		道路清扫	城市道路的冲洗及喷洒
		车辆冲洗	各种车辆冲洗
		建筑施工	施工场地清扫、浇洒、灰尘抑制、混凝土制备与养护、施工中的混凝土构件和建筑物冲洗
		消防	消火栓、消防水炮

2、回用水水质标准

回用水水质标准是确保回用安全可靠和回用工艺选用的基本依据。

为引导中水回用健康发展，确保回用水的安全使用，我国已制订了一系列城市污水回用水水质标准 ：

- **《城市污水再生利用 工业用水水质》**（GB/T 19923－2005）；
- **《城市污水再生利用 城市杂用水水质》**（GB/T18920－2002）；
- **《城市污水再生利用 景观环境用水水质》**（GB/T 18921－2002） 等。

城市污水再生利用类别（续）

序号	分类	范围	示例
3	工业用水	冷却用水	直流式、循环式
		洗涤用水	冲渣、冲灰、消烟除尘、清洗
		锅炉用水	中压、低压锅炉
		工艺用水	溶料、水浴、蒸煮、漂洗、水力开采、水力输送、增湿、稀释、搅拌、选矿、油田回注
		产品用水	浆料、化工制剂、涂料
4	环境用水	娱乐性景观环境用水	娱乐性景观河道、景观湖泊及水景
		观赏性景观环境用水	观赏性景观河道、景观湖泊及水景
		湿地环境用水	恢复自然湿地、营造人工湿地
5	补充水源水	补充地表水	河流、湖泊
		补充地下水	水源补给、防止海水入侵、防止地面沉降

《污水再生利用工程设计规范》（GB50335－2002）提出：

- 当再生水同时用于多种用途时，其水质标准应按最高要求确定；
- 对于向服务区域内多用户供水的城市再生水厂，可按用水量最大的用户的水质标准确定；
- 个别水质要求更高的用户，可自行补充处理，直至达到该水质标准。

(1)回用于工业用水水质控制指标

- 工业用水种类繁多，水质要求各不相同。
- 经深度处理后的污水主要可回用于冷却用水、洗涤用水、锅炉补给水及工艺与产品用水等。
- 工业冷却水用量大，使用面广，水质要求相对较低，是国内外污水回用于工业的主要对象。

深度处理后

- 直接水回用
  - 达到回用要求的城市污水回用于工业、农业、市政杂用等需水对象，最具潜力的是回用于工业冷却水、农田灌溉及市政杂用等
- 间接水回用
  - 城市污水按要求进行处理后排入水体，经自净后供给各类用户使用
  - 将经过深度处理的城市污水回灌于地下水层，再抽取使用
  - 几个城市位于同一条大河流域，都使用该水体作为给水水源和净化污水排放水体

(2)回用于城市杂用水水质主要控制指标

- 城市杂用水指经深度处理的城市污水回用于城市绿化、冲厕、道路清扫、车辆冲洗、建筑施工、消防等。
- 一般而言，回用于城市杂用水需要建设双给水系统，国内目前也有采用给水车送水的供水方式，但成本较高。
- 回用于城市杂用水的水质控制指标见下表。

《城市污水再生利用 工业用水水质》(GB/T 19923－2005)

项目	冷却用水		洗涤用水	锅炉补给水	工艺与产品用水
	直流式	敞开式			
基本要求	—				
色度 (度)	≤30				
嗅	—				
pH	6.0~9.0	6.5~8.5	6.0~9.0	6.5~8.5	
溶解氧	—				
COD_{Cr}	—	≤60	—	≤60	
BOD_5	≤30	≤10	≤30	≤10	
悬浮物SS	≤30	—	≤30	—	
溶解性总固体	≤1000				
浊度 (NTU)	—	≤5	—	≤5	
氨氮	—	≤10①	—	≤10	
总磷 (以P计)	—	≤1.0	—	≤1.0	
总氮	—				
石油类	—	≤1.0	—	≤1.0	

《城市污水再生利用 城市杂用水水质》 (GB/T18920－2002)

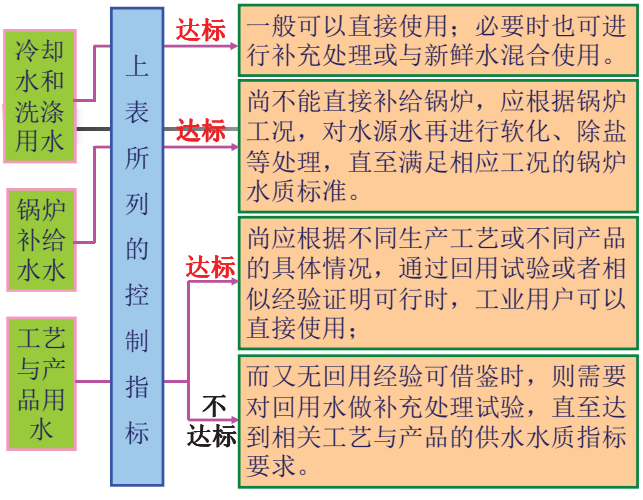
项目	冲厕	道路清扫消防	城市绿化	车辆冲洗	建筑施工
基本要求	—				
色度 (度)	≤30				
嗅	无不快感				
pH	6.0~9.0				
溶解氧	≥1				
COD_{Cr}	—				
BOD_5	≤10	≤15	≤20	≤10	≤15
悬浮物SS	—				
溶解性总固体	≤1500	≤1500	≤1000	≤1000	—
浊度 (NTU)	≤5	≤10	≤10	≤5	≤20
氨氮	≤10	≤10	≤20	≤10	≤20
总磷 (以P计)	—				
总氮	—				
石油类	—				

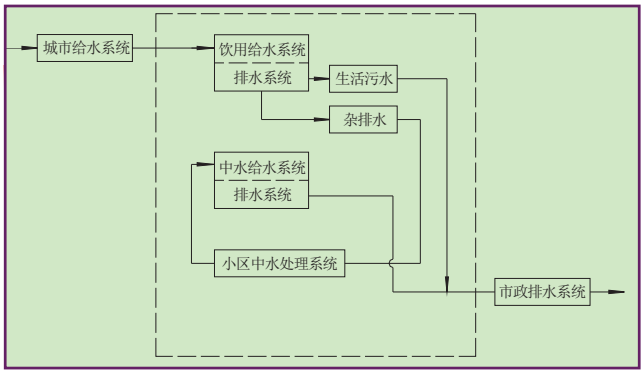
续表

项目	冷却用水		洗涤用水	锅炉补给水	工艺与产品用水
	直流式	敞开式			
阴离子表面活性剂	—	≤0.5	—	≤0.5	
铁	—	≤0.3			
锰	—	≤0.1			
氯离子	≤250				
二氧化硅	≤50		—	≤30	
硫酸盐	≤600	≤250			
总硬度（以$CaCO_3$计）	≤450				
总碱度（以$CaCO_3$计）	≤350				
总余氯	≥0.05				
粪大肠菌群/（个/L）	≤2000				
备注	① 当循环冷却系统为铜材换热器时，循环冷却系统水中的氨氮指标应小于1mg/L。				

续表

项目	冲厕	道路清扫消防	城市绿化	车辆冲洗	建筑施工
阴离子表面活性剂	≤1.0	≤1.0	≤1.0	≤0.5	≤1.0
铁	≤0.3	—	—	≤0.3	—
锰	≤0.1	—	—	≤0.1	—
氯离子	—				
二氧化硅	—				
硫酸盐	—				
总硬度（以$CaCO_3$计）	—				
总碱度（以$CaCO_3$计）	—				
总余氯	接触30min后≥1.0，管网末端≥0.2				
粪大肠菌群/（个/L）	≤3				
备注	混凝土拌合用水还应符合《混凝土用水标准》（JGJ 63-2006）的有关规定。				





杂排水作为水源的小区中水系统

(3)回用于景观环境用水水质主要控制指标

- 景观环境回用指经深度处理的城市污水回用于观赏性景观环境用水、娱乐性景观环境用水、湿地环境用水等 。
- 回用于景观环境用水水质主要控制指标见下表。

《城市污水再生利用 景观环境用水水质》(GB/T18921－2002)

项目	观赏性景观环境用水			娱乐性景观环境用水		
	河道类	湖泊类	水景类	河道类	湖泊类	水景类
基本要求	无漂浮物，无令人不愉快的嗅、味					
色度 (度)	≤30					
嗅	—					
pH	6.0~9.0					
溶解氧	≥1.5			≥2.0		
COD_{Cr}	—					

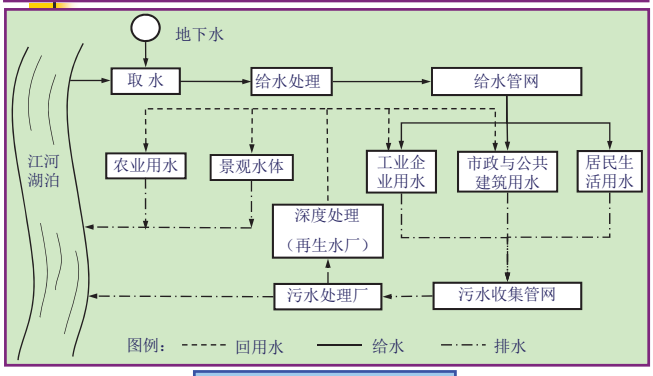
中水回用系统组成

- 中水回用系统
  - 污水收集：污水收集主要依靠城市排水管道系统实现；收集工业洁净水为源水的回用系统，可以利用城市排水管道，或另行建设收集管道
  - 回用水处理：（1）污水处理厂内部深度处理 （2）用户自行深度处理
  - 回用水输配：应建成独立系统，管道宜采用非金属管道，当使用金属管道时，应进行防腐蚀处理；当水压不足时，用户可自行建设增压泵站；回用水输配中必须采取严格的安全措施
  - 用户用水管理：应根据用水设施的要求确定用户的管理要求和标准

续表

项目	观赏性景观环境用水			娱乐性景观环境用水		
	河道类	湖泊类	水景类	河道类	湖泊类	水景类
BOD_5	≤10	≤6		≤6		
悬浮物SS	≤20	≤10		—		
溶解性总固体	—					
浊度 (NTU)	—			≤5		
氨氮	≤5					
总磷 (以P计)	≤1.0	≤0.5		≤1.0	≤0.5	
总氮	≤15					
石油类	≤1.0					
阴离子表面活性剂	≤0.5					
铁	—					
锰	—					
氯离子	—					
二氧化硅	—					

城市污水回用将给水和排水联系起来，实现水资源的良性循环，促进城市水资源动态平衡 。



城市污水回用系统

续表

项目	观赏性景观环境用水			娱乐性景观环境用水		
	河道类	湖泊类	水景类	河道类	湖泊类	水景类
硫酸盐	—					
总硬度（以$CaCO_3$计）	—					
总碱度（以$CaCO_3$计）	—					
总余氯	≥0.05②					
粪大肠菌群/（个/L）	≤10000		≤2000	≤500		不得检出
备注	②氯接触时间不应低于30min，对于非加氯消毒方式无此项要求。 注：1 对于需要通过管道输送再生水的非现场回用情况必须加氯消毒；面对于现场回用情况不限制消毒方式。 2 若使用未经过除磷脱氮的再生水作为景观环境用水，鼓励使用本标准的各方在回用地点积极探索通过人工培养具有观赏价值水生植物的方法，使景观水体的氮磷满足本表中回用于景观环境用水的水质要求，使再生水中的水生植物有经济合理的出路。						

2、深度处理技术

需对二级处理后的城市污水进行深度处理，去除污水处理厂出水中剩余污染成分，达到回用水水质要求。

这些污染物质主要是氮磷、胶体物质、细菌、病毒、微量有机物、重金属以及影响回用的溶解性矿物质等。

应根据回用水处理的特殊要求采用相应的深度处理技术及其组合。

城市污水回用深度处理基本单元技术有：混凝沉淀（或混凝气浮）、化学除磷、过滤、消毒等。

对回用水水质有更高要求时，可采用活性炭吸附、脱氨、离子交换、微滤、超滤、钠滤、反渗透、臭氧氧化等深度处理技术。

四、中水回用处理技术

中水处理技术按处理机理不同可分为物理化学处理法、生物处理法、膜处理法3大类。

•物理化学处理法:以混凝沉淀(气浮)技术和活性炭吸附技术相结合的基本方式，主要用于处理优质杂排水。适用于处理规模较小的中水工程，主要特点是处理工艺流程短，运行管理简单、方便，占地相对较小；但相对生物处理来讲，运行费用较大，并且出水水质受混凝剂种类和数量的影响，有一定的波动性。

•生物处理法:中水处理多采用好氧生物膜处理技术。适用于较大处理规模的处理工程，出水水质较为稳定，运行费用相对较小。

根据去除污染物的对象不同，二级处理出水可采用的相应深度处理方法参见下表 。

二级处理出水深度处理方法

污染物		处理方法
有机物	悬浮性	快滤（上向流、下向流、重力式、压力式、移动床、双层和多层滤料）、混凝沉淀（石灰、铝盐、铁盐、高分子）、微滤、气浮
	溶解性	活性炭吸附（粒状炭、粉状炭、上向流、下向流、流化床、移动床、压力式、重力式吸附塔）、臭氧氧化、混凝沉淀
无机盐	溶解性	反渗透、纳滤、电渗析、离子交换
营养盐	磷	生物除磷、混凝沉淀
	氮	生物硝化及脱氮、氨吹脱、离子交换，折点加氯

膜处理法：利用膜技术来处理水，使之符合一定的水质标准，常用形式为膜生物反应器，有效克服了与污泥沉降性能有关的限制，并起到了取代二沉池的作用，同时还能达到澄清和防菌的目的。对于已建成的污水处理厂，若改用膜生物反应器工艺，在不增加反应器容积的情况下，可使处理水量大大提高。膜生物反应器工艺具有出水水质好、占地少、易于实现自动控制等许多常规工艺无法比拟的优势，其在污水处理与回用中所起的作用也越来越大，并具有非常广阔的应用前景。但工程投资较大、处理成本较高。

3、处理技术组合与集成

污水回用处理工艺应根据处理规模、回用水水源的水质、用途及当地的实际情况，经全面的技术经济比较，将各单元处理技术进行合理组合，集成为技术可行、经济合理的处理工艺。

在处理技术组合中，衡量的主要技术经济指标有：处理单位回用水量投资、电耗和成本，占地面积、运行可靠性、管理维护难易程度、总体经济与社会效益等。

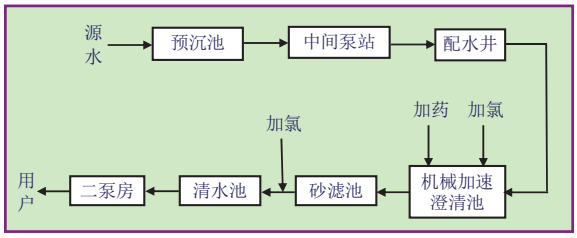
MBR膜生物反应系统

美国加利福尼亚州21世纪水厂回用水处理

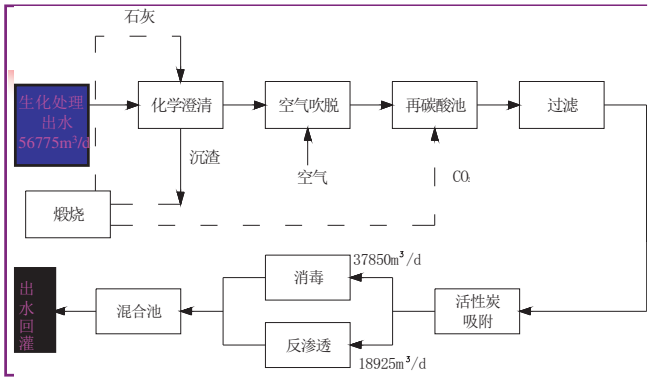
回用深度处理后的出水与深层地下水按一定比例混合后，通过注水系统注入地层，可以有效地控制海水入侵，并将经地下水层渗滤后的水回用于工业、农业等。

下图为北京高碑店污水处理厂回用深度处理工艺流程图：

- 源水：污水处理厂二级处理出水；
- 经深度处理后回用用途：主要供给热电厂冷却循环用水，以及城市绿化、道路喷洒和冲刷、河道景观用水等。



北京高碑店污水处理厂回用深度处理工艺流程图



美国加利福尼亚州21世纪水厂回用处理工艺流程图

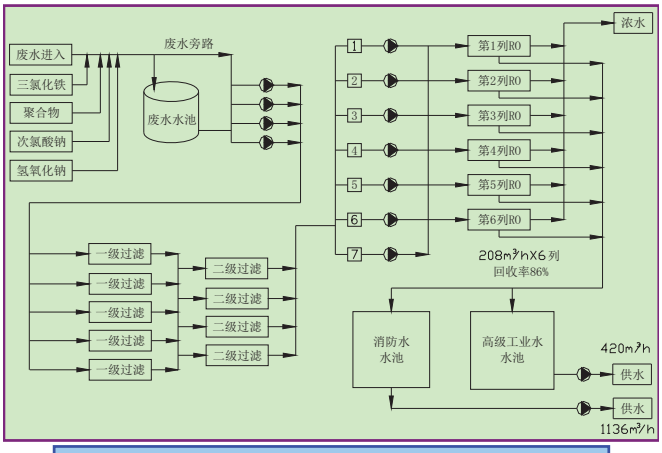
新加坡裕廊岛污水回用深度处理项目

裕廊岛是化工工业区，包括石化公司、化学公司及精炼公司等，回用项目以污水处理厂生化处理出水为源水，采用以双介质过滤作预处理的反渗透技术，深度处理后的出水达到了工业区内企业高级工业用水水质要求，解决了工业区水资源短缺的问题。

ADB AECOM

Industrial Sector Assessment
产业研究评估

- Industrial Context Analysis
- 产业方向分析
- Feedback from Existing Locators
- 入园企业调研反馈
- Liuchuan Industrial Park Positioning
- 刘川工业园定位
- Management & Environmental Management Concepts
- 运营与环境管理概念
- Industrial Demand Analysis and Results
- 工业需求分析



新加坡裕廊岛污水回用项目深度处理工艺流程图

Industry Sector Priority优先选择产业

Policy Perspective政策视角

Based on policy assessment for Gansu-Baiyin, industrial development direction would need to have:

- 相对于国家和区域水平上的当地资源优势 Local resource advantage from regional level not so much from provincial level
- 建立特色经济的潜力 Potential to build up the featured economy
- 推动产业链构建 Promote industry chain concept
- 允许产业转移经济 Allow industry transfer economy
- 吸引和留住員工的必要 Attract & retain necessary workforce
- 较强的市场导向性 Have a strong market-orientation
- 农村劳动力转移 Promote rural labor transformation
- 促進循環經濟 Promote a circular economy
- 加快工業化和城市化 Accelerate industrialization and urbanization
- 吸引國內外投資者Be attractive to domestic and foreign investors

Industrial Context and Analysis

产业内容及分析

Industry Sector Priority 优先选择产业

Short-list of Industries for Gansu-Baiyin LIP刘川工业园产业短名单

政策导向下的产业部门？结合传统产业并引入适宜在园区内集群发展的新兴产业？优化园区产业链概念并利用废弃物构建循

Recommend TRADITIONAL industries and EMERGING industries that can be clustered in the park;
Optimize park concept of industry chain ;
Use waste to create a circular economy; address the previous objectives

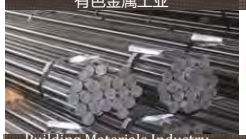
Industry Evaluation Criteria 产业选择维度	Policy related industry priorities 建议发展产业方向	
Criteria 1: Build's a solid industrial foundation 维度*1*：产业基础	稀土深加工	Rare earth new materials industry
Criteria 2: Uses local resource endowment 维度*2*：当地资源条件	有色金属深加工	Non-ferrous metal deep processing industry
Criteria 3: Strong market prospect 维度*3*：市场前景	煤化工产业	Coal chemical industry
Criteria 4: Improve development conditions of the site 维度*4*：园区开发条件	装备制造	Equipment manufacturing industry
Criteria 5: Reduce the environment impact by creating circular industry chain 维度*5*：通过构建循环经济链条降低环境影响	建材产业	Building materials industry
	底座與材料加工的高品質	High Quality Processing of Bases & Materials
	公用事業生產	Utilities Production

Industrial Demand Analysis工业需求分析

Industrial Context – Industrial Potential产业内容——潜在产业机会

West China, Northwest China, Gansu has potential for the following industries based on:
Value of Output and Volume of Output

Non-Ferrous Metals Industry 有色金属工业



Coal Chemical/Natural Gas 煤化工 /天然气

Chemicals and Chemical Products 化学品及化学产品

Building Materials Industry 建材产业

Equipment & Machinery 装备制造

High Quality Processed Foods 高品质食品加工

Industry Sector Priority 优先选择产业

Rare Earth and Related Industries稀土及相关产业

Key Industry suggestion: Rare earth new materials industry . Relies on current rare earth metallurgical industry, exploring downstream deep processing industries and establish rare earth industrial cluster in Gansu: - **主导产业方向建议：稀土新材料产业** –建议可以依托现有稀土冶炼加工产业项目，拓展下游新材料深加工领域，构建本地稀土产业集群

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• Used in the emerging technologies • National policies encourage the expansion of the downstream rare earth new materials deep-processing industry	• The most important rare earth metallurgical processing company in northern China, with the most advanced technology, is located near Liuchuan Park	• Explore downstream rare earth deep processing industry • Establish Gansu Province's rare earth industrial base • End products market: liquid crystal display, green lights, permanent magnet motor, NI-MH battery, luminescent material, etc.
• 稀土在新兴技术领域应用广泛，属于是国家战略资源； • 国家政策鼓励企业向稀土新材料下游深加工领域延伸	• 具有稀土产业基础，园区内有国内技术最先进的北方稀土冶炼加工企业	• 稀土新材料下游深加工领域，采用产业集群的发展模式； • 发展液晶显示、绿色照明、永磁电机、镍氢电池、发光器材等终端稀土产品的生产制造

Industry Sector Priority优先选择产业

Investment Perspective 投资视角：新西部开发的优先产业类别

- 整车生产（中方拥有较大产权份额） Production of whole vehicles (with Chinese majority ownership)
- 公共服务建设和城市气、热、给排水运营 Public service construction ,operation of urban gas, heat, and water supply and drainage systems
- 健康和养老服务 Health and senior care services
- 水果、蔬菜、鲜花种子生产（中方拥有控股权） Production of fruits, vegetables, flower seeds (Chinese party as controlling shareholder)
- 高品质葡萄酒基地建设 Construction of high quality wine grape bases
- 高品质啤酒原料耕作和加工 Cultivation and processing of high-quality beer raw materials
- 高端稀土应用产品加工 Processing of high-end rare earth application products
- 宽带服务和高附加值通讯业务 Broadband business services and value-added telecommunications business
- 高速公路运输公司 Highway transportation companies

The National Development and Reform Commission Issued (NDRC) and Ministry of Commerce (MOC) released the catalogue of priority industries for Central and Western China 2013. The catalogue is the basis of applicable policies for guiding the examination and approval of foreign investment projects and enterprises.

For Gansu the following are the priority industries:

国家发展和改革委员会和商务部发布的中西部地区优先发展产业。该目录是审查和批准外资投资项目和企业的政策基础

Industry Sector Priority 优先选择产业

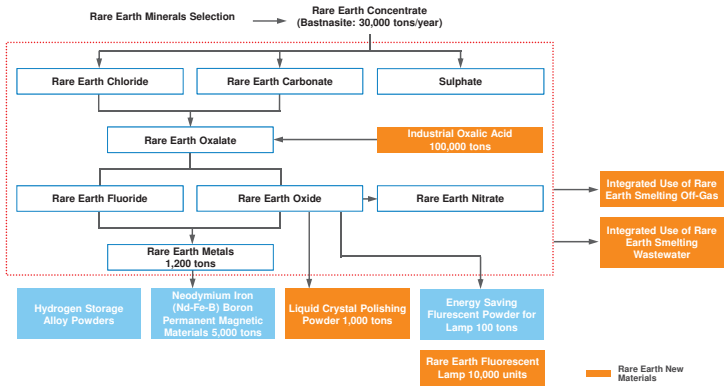
Non-Ferrous Metals and Related Industries

Key Industry suggestion: Non-ferrous metal deep processing industry - Based on its established industrial advantages and available resources, it is suggested that the park consider to explore downstream aluminum and other non-ferrous metals deep processing industry -**主导产业方向建议：有色金属深加工产业** –基于已经建立的产业优势和可利用资源，建议园区发展下游铝制品和其他有色金属深加工产业

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• National government accelerating structural adjustment for non-ferrous industries • Reducing cost is key and businesses are encouraged to relocate to energy-rich areas • Value of production is going to be reviewed	• Non-ferrous metals industry is competitive industry of Baiyin even if declining in production volume • Location advantage and development condition make Baiyin attractive to acquire mineral sources from Qinghai-Tibet Plateau	• Established aluminum electrolysis plants to develop integrated coal-electricity-aluminum projects; • As well as deep-processing downstream aluminum alloy products
• 中国有色金属产业进入升级调整期，产业面临布局优化； • 有效控制成本成为企业生存发展的关键，为能源丰富地区提供机遇 • 产品的价值将被重新评估	• 有色金属行业是白银市传统优势产业，即使产量有一定下降； • 区位优势和发展条件使得白银市具有整合周边青藏高原矿产富集区资源的潜力	• 依托已有电解铝企业，实现煤电铝一体化发展； • 发展铝下游加工行业，打造铝型材加工工业园

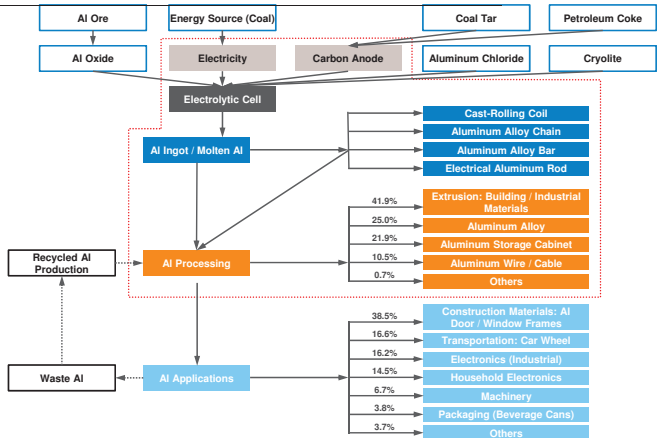
Industry Sector Priority 优先选择产业

Current Rare Earth Industrial Chain稀土产业现状产业链



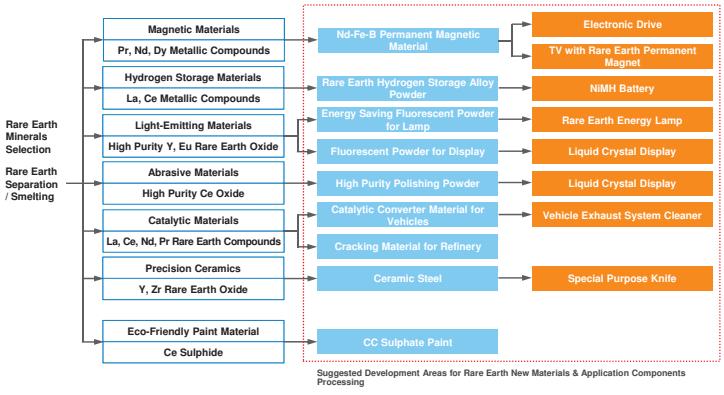
Industry Sector Priority 优先选择产业

Recommended Aluminum Products



Industry Sector Priority 优先选择产业

Recommended Rare Earth New Material Products推荐稀土新材料产品



Industry Sector Priority 优先选择产业

Equipment Manufacturing and Related Industries装备制造产业 –

Key Industry suggestion: Equipment manufacturing industry - Relied on government industrial policy and industrial transfer, it is suggested that the park establish automotive and new energy equipment manufacturing industry -**主导产业方向建议：装备制造产业** –建议可利用国家鼓励政策和产业转移趋势，与新兴产业结合，立足周边已有的整车等装备市场，培育新能源装备及汽车配套零部件为主的装备制造业

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• The development of equipment manufacturing industry is in line with national industrial policy; • Fast-growing new energy industry in Gansu will bring a huge demand for its equipment; • Fast-growing automotive in western China will increase the local demand for auto parts	• Near the wind energy equipment manufacturing base in Lanzhou; • Near the auto manufacturing base in Lanzhou	• Key parts of new energy equipment, such as wind turbines, control systems, special cables, etc. • Auto parts, advice and accessories for Lanzhou's automobile production base
• 提升产业结构，国家及甘肃政策鼓励发展产业； • 甘肃积极发展新能源产业将对新能源装备产生巨大需求； • 西部的汽车需求市场前景广阔，汽配产品将成为发展重点	• 甘肃省政府提出建设兰白风电整机成套设备产业化基地，可为兰州整机设备产业提供配套产品； • 临近兰州整车生产基地，可建立产业联系，承接配套零部件制造环境	• 发展风电机组、控制系统、特种电缆等新能源装备的关键部件； • 引进东部企业，发展汽车组装、零部件等汽车装备制造业；

Industry Sector Priority 优先选择产业

Building Materials and Related Industries建材及相关产业

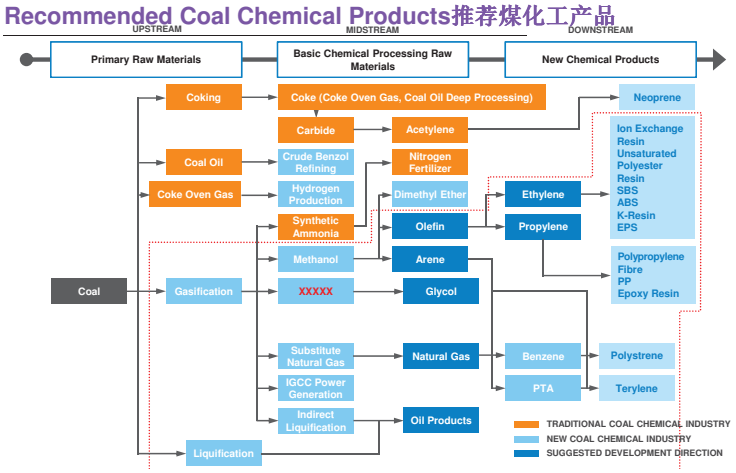
Key Industry suggestion: Building Material Industry - Due to the increasing demand for construction materials and local clay resources, suggested the park consider architectural ceramics products and also be a very important part of the Eco-chain industry to reduce the environment influence. -**主导产业方向建议：建材产业** - 建议充分利用本地丰富陶土资源优势，立足本地市场及中西部城镇化大开发的市场需求，发展建材陶瓷制品和水泥等产业，并能成为园区其他重工业的生态补链产业，降低园区的环境影响

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• Urban construction will increase demand for cement, ceramics and other building materials	• Baiyin's advantage in raw materials is its rich in clay resources of up to 400 billion tons; • The ceramics industry developed rapidly in recent years in Baiyin	• Production of sanitary ceramics, special ceramics, domestic ceramics, gardening, furnishings art, etc. • Establish itself as a base of ceramic product manufacturing in northwest
• 大规模城乡建设提升了对水泥、陶瓷等建材产品的需求	• 临近原料，全市拥有40亿吨陶土； • 具有水泥、建筑陶瓷等产业基础；	• 发展卫生陶瓷、日用陶瓷、特种陶瓷、陈设陶瓷等多种陶瓷制品制造； • 与平川工业园区共同构建西北部陶瓷工业生产中心

ADB AECOM

Industry Sector Priority 优先选择产业

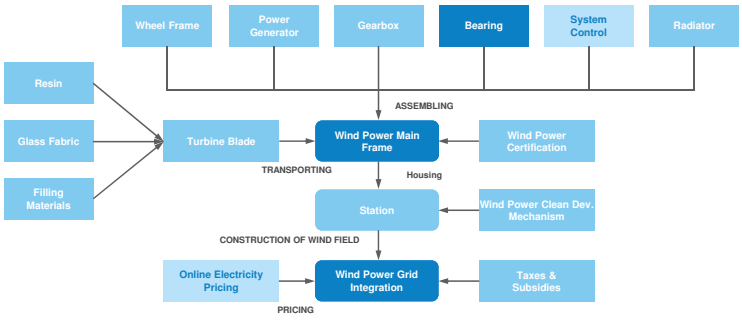
Recommended Coal Chemical Products推荐煤化工产品



ADB AECOM

Industry Sector Priority 优先选择产业

Recommended New Energy Equipment Manufacturing Products 推荐新能源装备制造产品



ADB AECOM

Industry Sector Priority 优先选择产业

High Quality Processing of Bases and Related Industries基地优势资源相关产业

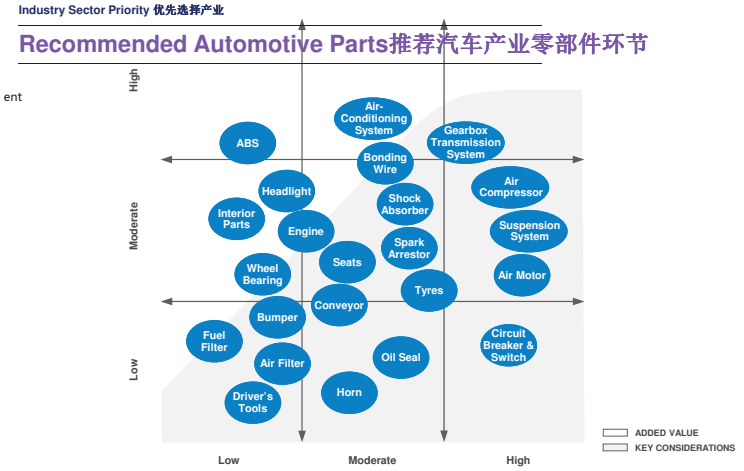
Key Industry suggestion: High Quality Processing of Bases- Based on its natural resource endowment and support from national government, it is suggested that the park encourage high quality agro-industries like beer and beverages -**主导产业方向建议：底座與材料加工的高品質**– 根據其自然資源稟賦和國家政府的支持，因此建議鈐響了園區鼓勵優質涉農行業，如啤酒和飲料

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• The NDRC and MOC released the catalogue of priority industries for Central and Western China used as a basis of applicable policies for guiding the examination and approval of foreign investment projects and enterprises.	• Jingyuan has rich agricultural products, and a fruit and vegetable cold-chain logistics center has been built in LIP • For Gansu the production of fruits, vegetables and flower seeds as well as the cultivation and processing of high quality beer raw materials are two priorities.	• Output value estimated to be CNY 6 B (2020) and CNY 24 B (2030). • The industry can support 3,000 (2020) and 11,200 (2030) direct employees in Baiyin. • Cumulative new employment generated is 4,300 by 2020 and 8,500 by 2030 within LIP.
• 國家發改委和建設部發布的優勢產業目錄為中國中西部地區作為指導外商投資項目和解決方案的審批適用政策的基礎。	• 農業靖遠擁有豐富的產品，以及水果和蔬菜冷鏈物流中心已建成LIP • 甘肅生產水果，蔬菜和花卉種子，以及高品質的原材料種植和加工是兩個優先級的啤酒。	• 預計產值為人民幣6 B（2020）和人民幣24 B（2030）。 • 該行業可以支持3,000（2020）和11,200（2030）白銀直接僱員。 • 累計產生的新的就業是4,300在2020年至8500到2030年之內LIP。

ADB AECOM

Industry Sector Priority 优先选择产业

Recommended Automotive Parts推荐汽车产业零部件环节



ADB AECOM

Industry Sector Priority 优先选择产业

Utilities Production and Related Industries公用事业相关产业

Key Industry suggestion: Utilities Production – Because of the large expected potential for LIP, demand for supporting utilities – water and power, sewerage/ sewage disposal and waste disposal is expected. -**主导产业方向建议：公用事業生產–** 由於預期巨大潛力的LIP，公用事業配套需求 - 水，電，污水處理/污水和垃圾處理處置的預期。

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• Considering the full development of LIP into a 50 square kilometer park, the facility will require a huge amount of water and power.	• LIP 2020 water demand is est. 59,300 cum/day, with total water & power requirements to increase over time. • Output value, production &supply of water, production & supply of electric power inc. waste resources and materials recycling & processing @ CNY 8.5B	• Output Value in Baiyin is est. at CNY 28.6 billion (2020), CNY 93.8 billion (2030). • Industry can support 14,200 (2020), 46,800 (2030) direct employees . • Cumulative new jobs of 4,300 by 2020 & 8,500 by 2030 within LIP.
• 考慮LIP的全面發展注入了50平方公里公園，該設施將需要大量的水和電力。	• LIP是東部時間2020年用水需求。59,300立方米/日，總供水，電力需求隨時間增加。 • 產值，產量及水的供應，生產和電力供應增量的。資源和材料廢物回收及處理@人民幣8.5B	• 白銀ESTLa產值。在十億人民幣28.6（2020），十億人民幣93.8（2030）。 • 產業可以支持14,200（2020），46,800（2030）直接僱員。 • 4,3008,500所，到2020年和2030內的LIP累積新的就業機會。

ADB AECOM

Industry Sector Priority 优先选择产业

Coal Chemical and Related Industries煤化工产业

Key Industry suggestion: Coal chemical industry - Based on its natural resource endowment and support from national government, it is suggested that the park consider to develop the profitable coal-based chemical industries -**主导产业方向建议：煤化工产业** – 虽然甘肃是资源枯竭城市，但白银市有相对于西部其他省市更好的产业发展基础，以及优越的区域交通资源，建议其可利用本地具有煤、水组合的优势，以及国家政策，建议发展以市场前景较好且便于运输的煤制油、煤制天然气为主的新型煤化工产业

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• China will continue largely relying on coal power for its energy for energy security purpose; • It is cost competitive as a substitute for oil chemical products; • Strong support for new coal chemical industry from national government, especially in the energy-rich Western Region	• Accessible to enough coal and water resources, which is vital to coal chemical industry; • Its arid and semi-arid continental climate can reduce the air pollution; • Accessible to W-E gas &oil transmission pipeline; convenient transportation network	• Current Reliable and profitable downstream products, including coal-to-oil and coal-to-natural gas
• 政策鼓励发展煤基能源，以保障国家能源安全； • 国内煤炭市场价格低迷，煤化工产业具备显著的经济效益； • 国家政策力挺新型煤化工，特别鼓励能源丰富的西部地区发展	• 可获得充足的煤炭、水源，可满足煤化工企业生产的需求； • 气候为干旱、半干旱大陆型气候，可减轻生产对环境的污染； • 拥有气油管网线和便利交通条件，便于原料运入及产品向东部地区输送	• 建议适当发展煤制油、煤制天然气当前两大新型煤化工产业的热点方向

LIP and Baiyin City Positioning and Role

Supporting Baiyin Economic Transformation 柳川經濟工業園在支持白銀轉型的作用

1. **Most important heavy industries industrial park in Gansu&Baiyin**
   - Part of industrial concentration of Baiyin's Overall Planning of the Development (2011-2020)
   - Planned as a provincial level economic and technological development zone.
   - Ideal relocation to consolidate large-scale industries into clusters scattered throughout the city
   - Allow clustering of heavy industries to cover full supply chain – upstream and downstream
2. **Identified as the center of 'Lanbai (Lanzhou-Baiyin) Economic Core Zone**
   - Can receive industrial transfers from Eastern and coastal regions
   - Expected to diversify economy away from natural resources towards equipment and new materials manufacturing.
3. **Accelerate industrialization and urbanization**
   - Provision of more job opportunities and alternatives (non-agricultural potentially higher income)
   - Requirement for service industries and utility industries
4. **Open to concept of circular economy**
   - Transition fromheavily pollutive and high resource dependent to eco-friendly

1. 最重要的重工業和白銀的工業園區在甘肅，產業集中發展的白銀總體規劃（2011-2020年）的區域內，計劃建設成為一個省級經濟技術開發區。
2. 確定為“藍白（蘭州 – 白銀）核心經濟區”的中心，用於接收來自東部和沿海地區白銀經濟有望多樣化，擺脫自然資源過向裝備製造和新材料產業轉移。
3. 提供了一個理想的區域整合分散到集群dịnh大型工業索伊整個城市。
4. 允許根據自己的重工業的上游和下游產業的集群。
5. 通過提供更多的就業機會的活動，非農業替代生計和收入對農村居民家庭潛在的更高的加速靖遠縣的工業化和城市化。
6. 願意採用循環經濟，其中白銀可以從嚴重污染型，高資源依賴型經濟過渡到環保的概念。

Industry Sector Priority 优先选择产业

Warehousing/ Logistics / ICD工业物流和仓储或公路集装箱中转站

Key Industry suggestion: Warehousing/ Logistics– Because of the large expected potential for LIP in terms of heavy industries, high value industries and mass distribution industries, supporting warehousing and logistics, which is common to industrial parks are necessary. -**主导产业方向建议：工业物流和仓储或公路集装箱中转站 –** 由于刘川工业园将在很大程度上发展重工业、高价值产业和大规模物流产业，支持性的仓储物流产业是十分必要的，这在工业园区里也是十分普遍的。

Background 背景	Existing Condition 現有條件	Impact and Recommendations 影響和建議
• Considering the large potential for heavy industries and mass volume industries, providing for warehousing and logistics facilities are a necessity.	• Already plans to build/ building new warehousing and logistics facilities connected to the transportation depot.	• Supports industrialization and urbanization process for LIP and Baiyin City
• 考虑到重工业、大型工业的巨大发展潜力，提供仓储物流设施是十分必要的	• 已经规划的或正在建设的仓储物流设施连接运输站	• 支持刘川工业园和白银市的工业化和城市化过程

LIP and Baiyin City Positioning

Potential For Full Development and Industry Transfer

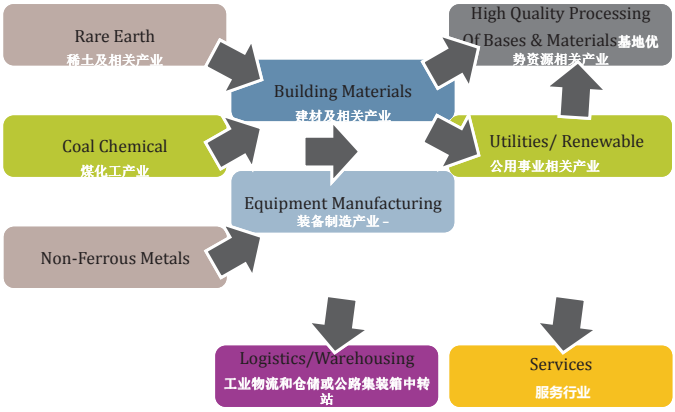
LIP具有很強的潛力可以開發並呈現出良好的dịnh面積大，中型工業

1. **LOCATION:** Location advantage and easy access to major cities
2. **TRANSPORTATION:** Potentially good transportation access
3. **DEVELOPABLE AREA:** Availability of large developable land or expansion area. The park's overall planning area of 50 square kilometers (or 5,000 hectares) is adequate for the construction of an industrial township.
4. **POWER:** Abundant coal and power source
5. **WATER:** Abundant and available water resource: in terms of raw and treated wastewater to support both domestic and industrial water requirements

1. 區位優勢，方便客人前往主要城市
2. 潛在的良好交通通道
3. 可發展的土地或大面積擴張。 50平方公里（或5000公頃），公園的總體規劃面積是足夠的一個工業小鎮的建設
4. 豐富的煤炭和電力來源
5. 豐富，水資源可利用：在原料和廢水處理方面，支持國內和工業用水需求

Industry Sector Priority 优先选择产业

Synergy / Clustering of Industries产业协同/聚类



Existing Land Use

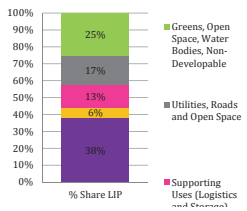
Liuchuan Industrial Park

LIP具有很強的潛力可以開發並呈現出良好的dịnh面積大，中型工業

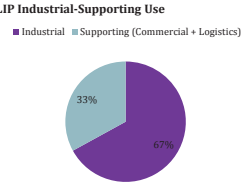
Code	Land Use	Land Area (Ha)
C	Public Amenities/Facilities	103.2
C1	Admin Office	45.1
C2	Commercial/Finance Business Office	13.8
C3	Cultural and Leisure	13.7
C6	Education and R&D	30.3
C9	Other Public Amenities/Facilities	0.4
M	Industrial	887.7
M2	2nd type of industrial space	550.7
M3	3rd type of industrial space	337.0
W	Storage	310.8
W1	Normal Storage Space	310.8
T	External Transportation	30.4
T1	Railway	11.0
T21	Highway	15.2
T23	Long Distance Bus Terminus	4.2
S	Road Open Space	310.7
S1	Roads	301.5
S22	Gathering Square for People	7.3
S3	Public Parking	2.0

U	U	Infrastructure	86.7
	U11	Water Supply	8.8
	U12	Electricity Supply	10.7
	U13	Natural Gas Supply	10.0
	U14	Heat Supply	8.6
	U21	Public Transportation	1.9
	U29	Other Transportation Facilities	1.2
	U3	Postal, Electrical Facilities	0.8
	U41	Rainwater, Wastewater Management	26.4
	U42	Solid Waste Management	0.2
	U7	Flood Prevention Facilities	17.1
	U9	Other Infrastructure	1.2
G	G	Green Space	554.8
	G11	Park	232.7
	G12	Street Greenery	102.0
	G22	Protected Green Space	220.1
	Sub-Total: Urban Dev't. Space Allocation		2,284.3
E	E	Water Bodies, Other Non-Urban Development	34.4
	Of which	Water Bodies	22.6
		Mountains	11.8
Total Planned Area			2,318.7

LIP Industrial Township



LIP Industrial-Supporting Use



Liuchuan Industrial Park Positioning

刘川工业园发展定位

Feedback from Existing Locators

入园企业调研反馈

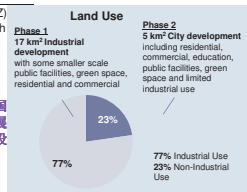
Planning Case Studies: Case Study 1

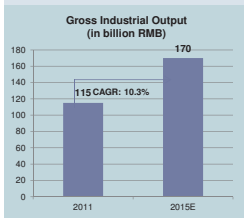
Baoji High-Tech Industrial Development Zone宝鸡高新技术产业区

Baoji Hi-Tech Industrial Development Zone (HIDZ) is one of the most successful state-level high-tech zones that has contributed to economic development of the Western region. Enterprises are attracted to its well-established infrastructure and ecological environment.

宝鸡高新技术产业开发区是西部最成功的国家级高新区之一，它为西部地区的经济发展做出了巨大贡献，企业由于其完善的基础设施和生态环境而选择入驻。

Baoji HIDZ	
Location	Baoji, Shaanxi陕西宝鸡
Year of Establishment	1992
Land Area	22 km² (2,200 ha)
Major Industries	Non-ferrous metals processing, machinery manufacturing, information technology, food processing 有色金属工业/机械制造/电子通讯/食品加工
No. of Companies	~3,000
Gross Industrial Output	RMB 115 billion (2011) RMB 170 billion (expected 2015)
Total Population	200,000





Interview Results from LIP Enterprises

LIP Advantages刘川工业园优势

List of Companies Interviewed:

- Landscaping company
- Water Company
- Gansu Rare Earth Company
- Gansu Hongtai Aluminum Company
- Gansu Kaisi Ceramic Company
- Baiyin Jiarui Ceramic Company
- Jingyuan Hongda Mining Company

访谈公司名录:

- 绿化公司
- 水务公司
- 甘肃稀土集团有限公司
- 甘肃省鸿泰铝业有限公司
- 甘肃凯斯瓷业有限公司
- 白银嘉瑞陶瓷有限责任公司
- 靖远宏达矿业有限责任公司

After interviewing with enterprises settled in LIP, we found that LIP has advantages in terms of production costs, resources, available land area, location, preferential policies and local market

通过对已入驻企业访谈发现，刘川工业园在成本、资源、土地、区位、政策、地区市场潜力方面的优势对企业具有吸引力

Advantages of LIP for Enterprises

Costs	• Low electricity prices: Current electricity price for industry is 0.5 yuan/kw/h, and it might be reduced to 0.37 yuan/kw/h • Low land acquisition cost: Current price of undeveloped land is only about 8,400 yuan/mu, a completely developed land will be sold at 70,000 yuan/mu
Resources	• Plenty of coal in surrounding area • Plenty of ceramic raw materials within 25-km area
Land	• Sufficient supply of land
Location	• Highly accessible by highways, railways, and high speed railways
Policies	• Preferential policies, such as 3-year tax exemption policy
Market	• The market potential of western region is gradually unleashed and the market is less competitive due to fewer competitors

园区吸引企业的优势

成本优势	• 低电价：园区工业电价仅为5毛/度，未来有可能降到3.7毛/度 • 低地价：目前园区未经平整土地价格仅为8,400元/亩，未来园区七通一平后土地价格将在7万元/亩左右
资源优势	• 周边煤炭资源丰富 • 周边陶瓷原材料供应充足，原料产地距离园区25公里范围内
土地优势	• 新建园区，土地供应充足
区位优势	• 园区可达性高，有高速公路、铁路、高铁通过
政策优势	• 提供优惠政策，如三年免税
市场潜力	• 西部地区的巨大市场潜力，较少的竞争者

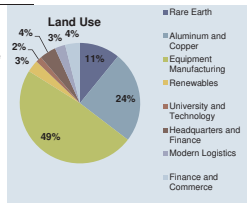
Planning Case Studies: Case Study 2

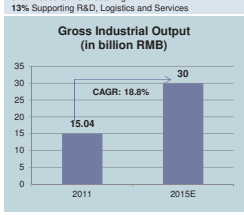
Baotou National Rare Earth High-Tech Industrial Dev't. Zone包头稀土高新区

Baotou National Rare Earth High-Tech Industrial Development Zone (NREHTIDZ) is the only state-level high-tech zone named after the rare earth industry. Not only is Baotou the largest rare earth industrial base in China, it is also famous for its facilities for the production of iron, steel, machinery, non-ferrous materials and textiles.

包头国家稀土高新技术产业开发区是稀土行业唯一的国家级高新区。其不仅是中国最大的稀土工业基地，也是国内著名的用于铁，钢，机械，有色金属材料和纺织品生产所需产品的重要供给基地

Baotou Industrial Development Zone	
Location	Baotou, Inner Mongolia
Year of Establishment	1990
Land Area	49 km² (4,900 ha)
Major Industries	rare earth metals, aluminum processing, copper smelting and processing, chemicals, motors and machinery engineering, silicon processing
No. of Companies	3,600+
Gross Industrial Output	RMB 15.04 billion (2011) RMB 30 billion (expected 2015)
Total Population	125,000



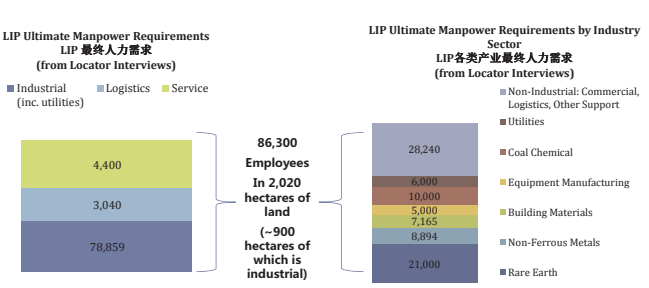


Interview Results from LIP Enterprises

Manpower Requirements人力需求分析

Summary of Land Requirements and Expected Numbers of Jobs Provided – Based on interviews with existing locators, we were able to get development potential from the perspective of existing locators.

土地需求和就業預估摘要 - 根據与目前驻园企业訪談结果，我們得出未来的发展潛力



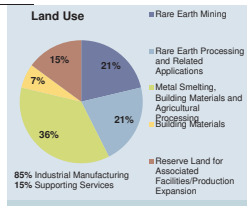
Planning Case Studies: Case Study 3

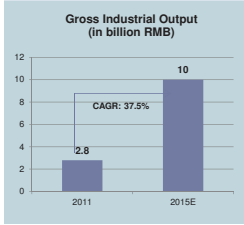
Miannning Rare Earth High Tech Industrial Park冕宁稀土高新产业园

Miannning Rare Earth High-Tech Industrial Park is a newly developed industrial base located in an area rich in superior light rare earth resources. The rare earth industry is a pillar industry in Miannning County, which is well-positioned to expand production, learning and research in the field of rare earth.

冕宁稀土高新技术产业园区是一个新兴的工业基地，周边有丰富轻稀土资源。稀土产业及其关联产业延伸是冕宁县的支柱产业

Miannning Rare Earth High-Tech Industrial Park	
Location	Miannning, Liangshan, Sichuan
Year of Establishment	2008 (first year of operations: 2011)
Land Area	23.5 km² (2,350 ha)
Major Industries	rare earth metals, non-ferrous metals, building materials, agricultural products processing
Gross Industrial Output	RMB 2.8 billion (2012) RMB 10 billion (expected 2015) RMB 30-50 billion (target for 2030)
Total Population	3,300





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International Case Study Examples 国际案例分析

Port of Rotterdam, Netherlands 鹿特丹港

Rotterdam, with access to markets all over Europe, is one of the world's major centers for oil and chemicals. The Port of Rotterdam contains the largest chemical cluster in the Netherlands with 4 major oil refineries, 40 petro-chemical companies, 3 industrial gas producers and 13 major tank storage and distribution companies.

Port of Rotterdam	
Location	Rotterdam, Netherlands
Year of Establishment	14th century
Land Area	12 km² (1,200 ha)
Major Industries	oil, gas and chemical
No. of Companies	109
Total Population	13,000
Closest Town / City	Rotterdam
Town / City Population	618,500

Management Strategy

- Rotterdam Port Authority, a government body is the owner, manager and developer for the chemical cluster.
- The Port Authority leases land and provides utilities and services.
- The cluster is organized around two key principles: co-siting and co-servicing.
- 集聚区组织有2个原则：“共同选址”和“共同服务”
- Co-siting means strategically co-locating companies to maximize synergy. “共同选址”意味着企业策略性地集聚在一起以促使协同作用最大化
- Co-servicing means the joint use of service providers such as maintenance contractors. “共同服务”意味着共用服务供应商,例如维修服务的承包商

Environmental Management

- Port Authority attempts to reduce waste by focusing on reuse. 港务管理局试图通过再利用的方式减少废弃物
- As such, they advise new companies on the most suitable locations based on the residues they require as raw materials or the residues they produce. 例如，他们建议新公司在最适宜的选址，基于他们需要用来做原料的残渣，或基于他们生产的残渣
- This allows plants who need to make use of others' residues as raw materials to be co-located. 这需要利用其它工厂的残渣为原料的工程在空间上集聚分布
- Also, with the depletion of liquid fossil energy sources, the Port Authority is focusing on biomass energy production.

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Management & Environmental Management Concepts 运营与环境管理概念

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International Case Study Examples 国际案例分析

Marl Chemical Park, Germany 马尔化工园区

Marl Chemical Park is one of the largest and most fully integrated parks in Europe. Producing over 4,000 chemicals, the park is operated by Evonik, who also provides a range of services to companies at the park such as waste management, site security, telecommunications and facility management.

Marl Chemical Park	
Location	Marl, North Rhine-Westphalia, Germany
Year of Establishment	1938
Land Area	6.5 km² (650 ha)
Major Industries	basic and specialty chemicals
No. of Companies	30
Total Population	3,400
Closest Town / City	Marl
Town / City Population	84,000

Management Strategy

- Marl Chemical Park is operated by Infracor GmbH, a wholly owned subsidiary of Evonik Degussa GmbH.
- Infracor provides a comprehensive range of services to companies such as waste management, safety and environmental protection, security, and telecommunication. 为许多公司提供广泛的服务，包括废物管理，安全、环境保护及通信。
- The park uses a 'plug-and-play' concept whereby new enterprises can tap into an existing comprehensive materials flow system, thereby lowering investment and operating costs. 为许多公司提供广泛的服务，包括废物管理，安全、环境保护及通信，

Environmental Management

- In terms of environmental management, Marl Chemical Park is building a new combined-cycle gas turbine (CCGT) power plant.
- Switching from coal to gas will allow the park to reduce carbon emissions by about 280,000 metric tons a year.

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International Case Study Examples 国际案例分析

Mid-America Industrial Park, USA 美国中部科学园区

MidAmerica Industrial Park (MAIP) is Oklahoma's largest industrial park, with nearly 80 firms located within the industrial park, including operations of seven Fortune 500 companies.

MidAmerica Industrial Park	
Location	Pryor Creek, Oklahoma, USA
Year of Establishment	1960
Land Area	36 km² (3,600 ha)
Major Industries	chemicals, industrial gases, plastics and paper production, food processing, light manufacturing and precision machining
No. of Companies	~80
Total Population	3,800

Management Strategy

- Governed and operated by a public trust, the Oklahoma Ordinance Works Authority, headed by Chief Administrative Officer.
- The public trust administers all services from marketing and water/wastewater treatment to airport operations and preventive maintenance of all major park assets. 此公营信托管辖范围内的服务广泛，包括市场营销、用水及污水处理、机场运营及所有园区内主要资产的预防性维修。
- Availability of On-site Training Centers. 基地内是否有培训中心

Environmental Management

- MAIP offers the most competitive utility rate structure of any industrial park in the nation. 提供全国所有产业园区中最有竞争力的公用事业收费。
- On-site facilities include water and wastewater treatment systems, electricity and natural gas.
- Telecommunication assets are also superb including wireless internet, DSL, broadband fiber optic networks, videoconferencing and two points-of presence (POP's).

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International Case Study Examples 国际案例分析

Chemical Park Delfzijil, Netherlands 代尔夫宰尔化工园区

The local availability of rock salt and natural gas was a key factor leading to the development of the second largest chemical cluster in the Netherlands at Chemical Park Delfzijl. Through advanced processes, these raw materials are converted to chlorine, hydrogen, caustic soda and methanol.

Chemical Park Delfzijl	
Location	Delfzijl, Groningen, Netherlands
Year of Establishment	1954
Land Area	14.7 km² (1,470 ha)
Major Industries	chemical
No. of Companies	11
Total Population	1,250
Closest Town / City	Delfzijl
Town / City Population	25,700

Management Strategy

- Chemical Park Delfzijl is operated by Akzo Nobel.
- The main management concept is based on collaboration whereby companies exchange raw materials and share supplies. 主要的管理概念是基于企业间互相交换原材料、共享供应品的合作系统。

Environmental Management

- All companies at Chemical Park Delfzijl have signed the international Responsible Care program, which is a package of measures whose end goal is the preservation of the environment. 所有在Delzikl化学产业园的公司都签订了国际责任关怀计划，即是一系列以维护环境为最终目标的措施。
- Responsible Care covers issues such as production process, storage, distribution and waste processing. 责任关怀计划包含生产流程、储存、分布及废物处理程等事项。
- As well, the park encourages a waste-to-resource strategy which aims to reduce waste and lower dependence on fossil fuels. 另外，产业园区采取废物资源化的策略，此策略的目的为减少废物及减少对化石燃料的依赖性。

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International Case Study Examples 国际案例分析

Chempark Leverkusen, Germany石湾勒沃库森

Established in 1891, Chempark Leverkusen is located in the North Rhine-Westphalia region of Germany. It employs over 30,000 people and houses over 70 manufacturing and service companies.

Chempark Leverkusen	
Location	Leverkusen, North Rhine-Westphalia, Germany
Year of Establishment	1891
Land Area	4.8 km² (480 ha)
Major Industries	chemical, pharmaceutical, high-tech
No. of Companies	70+
Total Population	28,000 employees
Closest Town / City	Leverkusen
Town / City Population	160,000

Management Strategy

- CURRENTA is the manager and operator of CHEMPARK Leverkusen, Dormagen and Krefeld-Uerdingen
- The company is a joint venture between Bayer AG and LANXESS AG
- With over 70 companies at Leverkusen, the chemical park has been designed to promote collaboration and efficiency化学产业园区拥有超过70家公司，此园区的设计理念为鼓励合作及提高效率。
- Services offered include material and energy supply, analytical services and environmental management 提供服务包括材料及能源供应，分析服务及公营信托

Environmental Management

- CURRENTA Environment (CURRENTA's environment business unit) is responsible for waste disposal Currenta环境部《即Currenta公司的环境营业单位》主要负责废物处理。
- Key philosophy involves waste avoidance (first choice), recycle/re-use of waste (second option) and safe disposal (last option) 核心理念包括避免产生废物《第一选择》，废物再循环利用《第二选择》及安全处置《最后选择》。
- CURRENTA provides the following services to companies located at CHEMPARK: secure landfill for hazardous waste, hazardous waste incineration, vessel cleaning, political lobbying for environmental policies, environmental monitoring, recycling

Industrial Demand Assessment

LIP Unique Positioning 刘川工业园特点

Advantages 优点

- Policy support政策支持
- Suitable available market 合适的市场
- Investor preference 投资者青睐
- Unique management style/ concept 独特的管理风格/概念
- Unique environmental management offering: circular economy, waste to energy, zero-waste, EIP facility独特的环境管理：循环经济、废物变能源、零排放、EIP设施
- Strong industrial base in terms of size and scale 从规模来来看，有强大的基础
- Comprehensive and available support uses – utilities, services, logistics under a competitive utility rate structure 综合支持 – 市政、服务、物流
- Available labor force 劳动力
- Smart clustering of industries 明智的工业团

LIP Unique Selling Points

Visioning/Positioning 愿景

- The most important and sought after heavy industries park

在重工业园后最重要的工业园

- Positioned as a fully functioning, master planned and well managed industrial township 全功能、总体规划、管理良好
- Offering comprehensive environmentally sensitive management practice

环境友好的管理实践

- Promoting green industries and renewable energy

鼓励绿色工业和再生能源

- Offering lots of green and open space

提供绿色和开发空间

- And considered a significant social and economic transformation for Baiyin City and Gansu 对于白银和甘肃省来说都是重要的经济和社会的转型

Summary Findings from International Case Study Examples 国际案例借鉴摘要

Management Concepts 运营理念

International IP's are managed by a single operator that co-sites enterprises to maximize synergy and efficiency. The same operator will often offer a full range of services ranging, i.e. waste management, telecommunication, etc. Supporting companies to focus on core business. 由单一运营商管理，以提高协同效应和效率。该运营商同时会提供全方位的服务，例如废物管理电信等配套，支援企业专注于核心业务上。

Main Operator Organizes Structure of Park 主要运营商安排园区结构

- i.e. Marl Chemical Park is managed by a single operator (Infracor GmbH).

Co-Siting to Maximize Synergy and Efficiency 共址，以最大限度地提高协同作用和效率

- The Rotterdam Port Authority advises companies on best locations based on residues required as raw materials inputs.

Co-Servicing Companies 联合服务

- The Port of Rotterdam promote co-servicing, the joint use of service providers.

'Plug-and-Play' to Attract New Enterprises 配套完善以吸引新企业

- 'Plug-and-play' concepts are used to attract new enterprises providing a comprehensive materials flow system and cost savings.

Main Manager/Operator Organizes Structure of Park and Provides Services


Co-Siting to Maximize Synergy and Efficiency


Co-Servicing to Allow Companies to Focus on Core Business


Plug-and-Play Concept to Attract New Enterprises

Industrial Demand Assessment

Industry Sector Objectives 工业发展目标

1. Ensure that there is market support for more industrial space in Baiyin and in LIP;
2. Measure economic impact of industrial development in Baiyin in terms of jobs and value of output;
3. Establish the types of industrial requirements
4. Establish types of support and workers to support this demand;
5. Estimate new / additional industrial land demand;
6. Assume LIP's capture of this new demand;
7. Estimate size of supportable population working and living in LIP generated through direct industrial jobs and supporting service jobs; and,
8. Propose *a unique positioning* and *long-term land use program* for the entire 52sqkm LIP.

- 確保有在白銀和LIP更多的工業用地的市場支持;
- 在測量作業和輸出以價值計算的白銀工業帶動發展的社會經濟利益;
- 確保所需的各類工業及配套的工人來支持這種需求;
- 估計新的工業用地需求在白銀;
- 承擔這一新的需求LIP的捕捉合理的假設;
- 估計人口工作和生活在由工業直接就業和間接就業機會支持生成LIP的大小;和,
- 提出了一個長期的土地使用計劃為整個52sqkm嘴唇。

Summary Findings from International Case Study Examples 国际案例借鉴摘要

Environmental Management Concepts 环境管理理念

Recognizing the value of responsible environmental management concepts, international industrial parks employ a number of common strategies to minimize environmental harm while identifying ways to promote efficiencies and synergies. 正视负责任的环境管理理念的价值，国际工业园区运用一些共同的战略以减少对环境的危害，同时找出促进效率和协同效应的方法。

Reuse of Waste as Raw Materials – No Waste 废料当原料再利用

- The reuse of waste from one process as raw material for another is an increasingly common way to minimize waste creation.

Increasing Focus on Renewable Energy 越加重视再生能源

- Plants have been shifting to more renewable sources of energy such as biomass.

Recycling Provided by Park Operator 园区运营商提供回收利用

- Recycling is often provided by the park operator such as CURRENTA at Chempark Leverkusen.

Safe Disposal of Hazardous Waste 安全处置危险废品

- Also, park operators will often help enterprises dispose hazardous waste. CURRENTA operates incineration plants and landfill sites.


Reuse of Waste as Raw Materials


Increasing Focus on Renewable Energy


Recycling Services Provided by Park Manager/Operator


Safe Disposal of Hazardous Waste to Minimize Environmental Impact

Industrial Demand Analysis: Part 1

Priority Industry Market Contribution & Market Potential

优先产业的市场贡献及潜力

1. Prepare a short-list of industries 准备一个产业短名单
   - Per industry Gansu & Baiyin;
   - 甘肃及白银的每个产业
   - Record historical value of output and number of employees (2008, 2011)行业产值及就业人口历史记录
2. Check potential for growth in Baiyin寻找白银增长的潜力
   - Related to CAGR at city, provincial and national levels
   - 国家、省及城市的年均增长率
3. Estimate value of output of across Gansu预估甘肃省的产出
   - Use 2011 values to arrive at 2013 estimate or base year利用2013-2013年的数据
   - Estimate vale of output 2013 to 2033估测2013到2033年的产出
4. Estimate Baiyin's Current & Potential Market Share预估白银的现状及潜在市场份额
   - In terms of output value share of provincial total 2013 to 2033根据2013到2033年省的产出比例
5. Determine Baiyin's Incremental Increase in Market Share 在市场份额逐步增加

- Assume that with infrastructure development & policy support, LIP industries will have Growth Factor of 1%
- 假设基于基础设施及政策支持，刘川工业园将有1%的增长
- But, if industry not established but has potential for inducing industrial transformation, apply higherGrowth Factor of 2%
- 如果产业尚未建立但具有潜力或诱发转型，可以设定增长率为2%
- Note: Equipment manufacturing/ hi-tech can benefit & create strong service industry. Utilities industries supports industrial transformation.
- 注：装备制造及高新产业可以引致现代服务业，公用事业有利于支持产业转型

LIP Positioning and Industrial Demand Analysis

工业需求分析

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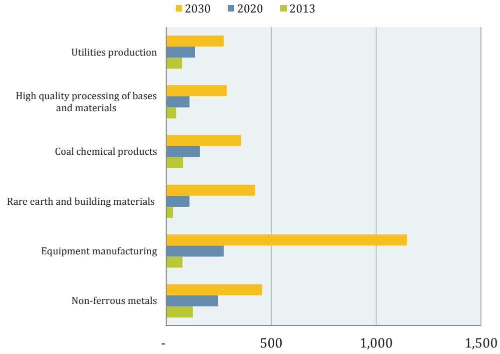
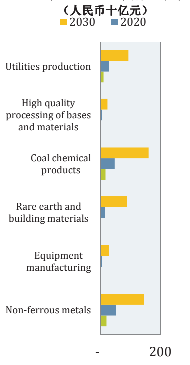
Industrial Demand Analysis 工业需求分析

Priority Industries Value Contribution 优先产业的产值贡献

Industry Contribution to Gansu Province 2013 and 2030 Value of Output in CNY Billion
甘肃省2013-2030年各产业的产值（人民币十亿元）



Industry Contribution to Baiyin City 2013 and 2030 Value of Output in CNY Billion
白银市2013-2030年各产业产值（人民币十亿元）



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Industrial Demand Analysis: Catalogue of Industries 工业需求分析：产业名单

Priority Industries Expanded List of Industries优先选择名单

NON FERROUS METALS 有色金属工业

- Non-ferrous metals mining and dressing 有色金属采掘及洗选
- Smelting and pressing of non-ferrous metals有色金属冶炼加工

EQUIPMENT MANUFACTURING INDUSTRIES 装备制造业

- Metal products 金属制品
- General Purpose Equipment Mftg. 一般装备制造
- Special Purpose Transport & Equipment Mftg 特殊装备制造，交通设备
- Electric Equip. Machinery 电力设备
- Telecommunication Equipment通讯设备
- Computer & Other Electronic Equipment 电脑及其他电子设备
- Instruments, Meters, Cultural & Office Machinery 仪器仪表、文化办公设备
- Arts and Other Manufacturing 艺术及其他制造

RARE EARTH PRODUCTS & BUILDING MATERIALS INDUSTRIES 稀土产品及建材产业

- Non-Metal Minerals Mining and Dressing 非金属矿采选业
- Non-Metal Mineral Products 非金属矿物制品业

COAL CHEMICAL煤化工, CHEMICAL INDUSTRIES 化学品产业

- Coal Mining and Dressing 煤炭开采和洗选业
- Raw Chemical Materials and Chemical Products化学原料及化学制品制造业
- Medical & Pharmaceutical Products医疗和制药产品
- Chemical Fiber化纤
- Plastic Products塑料制品

HIGH QUALITY PROCESSING OF BASES AND MATERIALS 原料优势产业

- Agriculture and Sideline Food Production 农业和农副食品生产
- Food Production食品生产
- Beverage Production饮料制造业

UTILITIES PRODUCTION, RENEWABLE RESOURCE INDUSTRIES 公用事业及资源利用产业

- Waste Resources and Materials Recycling & Processing 废弃资源和废旧材料回收加工
- Production and Supply of Water 水生产和供应
- Production and Supply of Electric Power and Heat 电力热力生产和供应业

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Industrial Demand Analysis: Part 1 工业需求分析 （1）

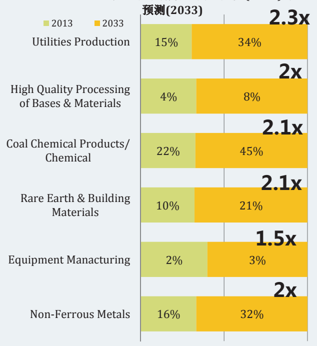
City and Provincial Share of Industry Output Value 白银与甘肃产业产值占比分析

Estimate Potential for Growth: Growth Factor by Industry

	Output Value (in 10,000 CNY for Baiyin and Gansu); (in 100,000,000 CNY for China)	Baiyin 2011	Gansu 2011	Potential for Growth Provincial	Potential for Growth National	Growth Factor
	NON-FERROUS METALS					
1	Nonferrous Metals Mining and Dressing	20,864	594,500	LOW	HIGH	1.0%
2	Smelting and Pressing of Nonferrous Metals	1,559,668	9,859,581	LOW	MODERATE	1.0%
	EQUIPMENT AND HIGH-TECH INDUSTRIES MANUFACTURING					
3	Metal Products	5,005	731,913	HIGH	HIGH	2.0%
4	General Purposes Equipment Manufacturing	34,254	564,463	LOW	HIGH	2.0%
5	Equipment Manufacturing For Special Purposes	4,534	682,800	LOW	HIGH	2.0%
6	Transport Equipment Manufacturing	40,374	297,255	LOW	MODERATE	2.0%
7	Ele[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.0%
8	Telecommunication Equipment, Computer and Other Electronic Equipment	-	250,266	FAIR	FAIR	2.0%
9	Instruments[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.0%
10	Arts and Other Manufacturing	-	515,252	MODERATE	HIGH	2.0%
	RARE-EARTH PRODUCTS & BUILDING MATERIALS INDUSTRY					
11	Nonmetal Minerals Mining and Dressing	4,786	154,122	FAIR	HIGH	1.0%
12	Nonmetal Mineral Products	208,237	2,070,055	MODERATE	HIGH	1.0%
	COAL-CHEMICAL, CHEMICAL PRODUCTS					
13	Coal Mining and Dressing	547,422	2,407,281	MODERATE	MODERATE	1.0%
14	Raw Chemical Materials and Chemical Products	751,436	3,171,233	FAIR	HIGH	1.0%
15	Medical and Pharmaceutical Products	20,091	623,331	FAIR	MODERATE	1.0%
16	Chemical Fiber	-	34,015	LOW	MODERATE	1.0%
17	Plastic Products	18,720	316,428	FAIR	HIGH	1.0%
	HIGH-QUALITY PROCESSING OF BASES AND MATERIALS					
18	Agriculture and Sideline Food Production	108,847	2,204,045	MODERATE	HIGH	1.0%
19	Food Production	8,232	541,076	MODERATE	MODERATE	1.0%
20	Beverage Production	21,418	1,011,612	FAIR	MODERATE	1.0%
	UTILITIES PRODUCTION/RENEWABLE RESOURCES					
21	Production and Supply of Water	2,406	76,587	LOW	MODERATE	2.0%
22	Waste Resources and Materials Recycling and Processing		18,709	FAIR	HIGH	2.0%
23	Production and Supply of Electric power and heat	842,833	6,229,751	FAIR	FAIR	2.0%
	TOTAL	4,222,478	31,540,522			

Source: Baiyin Municipality, Gansu Province, Statistical Yearbook 2009, 2012

Baiyin Current & Projected Market Share of Gansu Industrial Output Value 白银产业占甘肃省比例 – 现状 (2013)与预测(2033)



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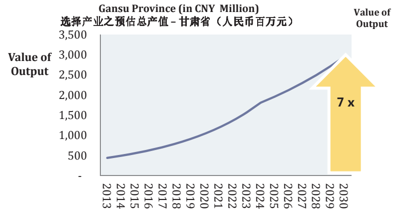
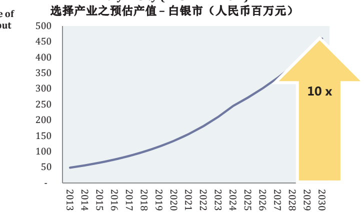
Industrial Demand Analysis 工业需求分析

Estimate of Growth in Value of Output 产值成长预估

Projected Growth in Value of Output for Selected Industries - Gansu Province (in CNY Million)
选择产业之预估总产值 – 甘肃省（人民币百万元）



Projected Growth in Value of Output for Selected Industries - Baiyin City (in CNY Million)
选择产业之预估产值 – 白银市（人民币百万元）



Gansu's selected industry is estimated to grow by 7x. Baiyin's same industries, with the development of several large industrial parks like LIP, is expected to growth by up to 10x during the same period.

Baiyin will increase its share of the province's value of output from 10% to 15% by 2030.

ADB AECOM

Industrial Demand Analysis: Part 2 工业需求分析（2）

Priority Industry Economic Impact 优先产业经济影响评估

1 Estimate Value of Output Per Direct Employee by Industry in Gansu Province

预估每名直接就业所创造的产业产值（甘肃省）

- Using Employee Data per Industry Sector Across Gansu Province and Baiyin City — 使用白银市与甘肃省各产业历史就业资料库
- Assume efficiency increases over time by 2%-2.5% (as indicated by decrease in employees per annum) — 假定年生产效率提升2%-2.5%（如就业人数下降所示）

2 Estimate Baiyin Direct Employment using average Output Value/ Employee

根据每名就业人数的平均产值，预估白银直接就业

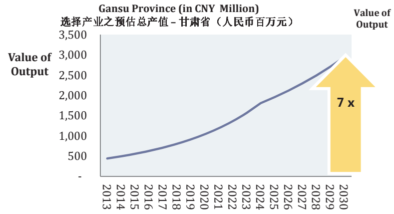
- Estimate Baiyin's current and projected market share of Gansu's Output Value — 预估白银目前以及未来在甘肃省的产业市场占有率
- From Baiyin's estimated Annual Output Value per Industry, use Average Output Value Per Industry Per Employee in Gansu — 根据白银每个产业的估计年产值，使用甘肃省每个产业员工平均产值
- Estimate Baiyin's Annual Incremental Increase in Direct Employment on Output Value — 估计白银年度直接就业之年增量所创造的产值
- Estimate Baiyin's Cumulative Employment Generated — 估计白银的累计就业

ADB AECOM

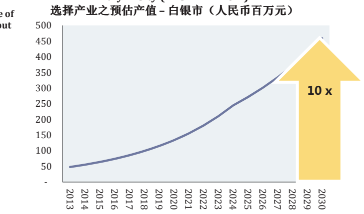
Industrial Demand Analysis 工业需求分析

Estimate of Growth in Value of Output 产值成长预估

Projected Growth in Value of Output for Selected Industries - Gansu Province (in CNY Million)
选择产业之预估总产值 – 甘肃省（人民币百万元）



Projected Growth in Value of Output for Selected Industries - Baiyin City (in CNY Million)
选择产业之预估产值 – 白银市（人民币百万元）



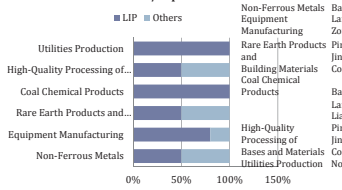
Gansu Industries Output Value CAGR	2008-2011 CAGR	2013-2033 Effective Ave. CAGR
NON-FERROUS METALS	12%	8%
EQUIPMENT MANUFACTURING INDUSTRY	26%	17%
RARE-EARTH PRODUCTS & BUILDING MATERIALS INDUSTRY	25%	17%
COAL-CHEMICAL PRODUCTS	9%	9%
HIGH-QUALITY PROCESSING OF BASES AND MATERIALS	22%	11%
UTILITIES PRODUCTION	14%	8%

Gansu's selected industry is estimated to grow by 7x. Baiyin's same industries, with the development of several large industrial parks like LIP, is expected to growth by up to 10x during the same period.

Baiyin will increase its share of the province's value of output from 10% to 15% by 2030.

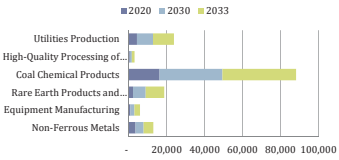
LIP Industrial Demand and Penetration LIP 工业需求与普及程度

Est. Penetration/Capture Rate



Industry Priority	Competition
Non-Ferrous Metals	Lianhai & Jiuzhou Devt. Areas, Baiyin Hi-Tech Park
Equipment Manufacturing	Lanzhou Hi-Tech Industrial Devt. Zone
Rare Earth Products and Building Materials	Pingchuan Economic Devt. Area, Jingtai & Huining Industrial Concentration Areas
Coal Chemical Products	Baiyin Hi-Tech (only for chemicals) Lanzhou Economic Devt. Area, Lianhai and Jiuzhou Devt. Areas, Pingchuan Economic Devt. Area, Jintai & Huining Industrial Concentration Areas
High-Quality Processing of Bases and Materials	Not Applicable
Utilities Production	

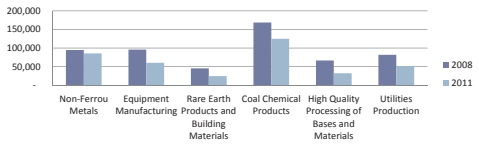
LIP New Employee Demand Penetration/Capture



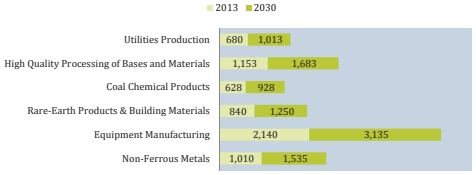
- Demand has to be tested against expected penetration of LIP 需求必须相较与LIP的预期渗透进行测试
- Because of competition in non-ferrous metals, rare earth-building materials, high quality processing of bases, capture is expected to be 50%.因为对于非有色金属，稀土建材，鲍的高質量處理的競爭，捕獲預期為50%。
- Expect higher penetration of 80% for equipment manufacturing as LIP is expected to allow for all kinds of equipment manufacturing industries unlike offered in the other 5 park + 1 parks.预期装備製造有更高的滲透率為LIP有望讓各種裝備製造業進驻
- There will be a 100% demand for coal chemical products and site specific utilities production in LIP because the former is a very novel and policy supported industry, while the latter is specific to LIP's needs.這裡將对于煤化工產品和特定公用事業生產有100%的需求，因為前者是一個非常新穎和政策支持的行業，而後者則是針對LIP的需求。
- LIP can only capture a portion of this demand, related to being able to entice/offer better facilities, service and incentives to locators LIP只能捕捉到部分需求，而這与能提供更好的設施，服務和激勵機制以吸引企业入驻相关
- An estimated 28,000 in 2020 and 56,000 in 2030 industrial workers are captured by LIP估计LIP在20 20年能吸引28,000个工人，2030年有56,000个

Estimated Output Value per Employee by Industry 按行业每名员工预估产值

Value of Output Per Employee, Gansu (2008 and 2011)
甘肃省员工平均产值



Estimated Output Value in '000 CNY per Employee per Industry Sector over time 按行业员工平均产值预估（千元）



- Employees supported: 550,000 (in 2008) and 380,000 (in 2011) by industries in Gansu Province.甘肃省工业支持550,000（2008年）和380,000（2011年）名就业。
- Output value contribution of each of employee can be estimated by comparing total employees with total output value.每个员工平均产值贡献可以透过比较员工总数与总产值来估计。
- Value of output (production) per direct employee in Gansu province is used as a parameter for estimating total direct employees in Baiyin when compared with total output value.甘肃省每个就业人员的平均产值被视为参数，与白银的总产值比较以得出白银总直接从业人员
- Number of employees per industry is decreasing indicating increase in operational efficiency over time.每个行业的员工人数呈现递减趋势，表示行业内运营效率逐步提升。
- It is assumed that operational efficiency of each industry improves over time; so a growth of approximately 2% to 2.5% per annum is applied. 假定每个行业的运营效率随着时间逐渐提高，因此套用2%至2.5%的年成长率

Industrial Land Demand and Phasing 工业土地需求与分期开发

1 Gather case study metrics on Employee per Hectare
收集案例得出每公頃用地之職工數為标杆指標

- Look into case studies from China, with similar types of industries — 研究案例來自中國相似類型的行業
- Reconcile with inputs from existing locators in LIP on expected employees versus total negotiated industrial land — 調和現有的入驻企业的預期员工數以及总工业用地

2 Estimate Total Industrial Land Demand in Hectares
估算總工業用地需求（公頃）

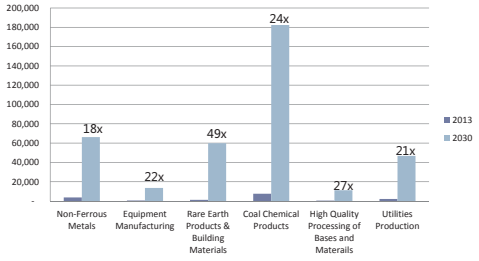
- Use Direct Employment Divided by Parameters on Employment per Hectare — 使用直接就業除以每公頃就業的參数
- Assume that LIP is the largest heavy industries/ industrial park in Baiyin (for selected industries) — 假設LIP是白银最大的重工業/工業园区

3 Develop LIP in phases depending on the demand
根據需求制定LIP分期

- Show existing and negotiated industrial land. — 顯示現有的和協商的工業用地。
- Show phased demand for 2020, 2030 and 2033 — 顯示分階段需求（2020年，2030年和2033年）

Estimated Number of Direct Employees by Output by Industry 按行业估计

Baiyin Direct Employment on Output



- The average output value per direct employee in Gansu for the selected priority industries is used to estimate the numbers of employees in Baiyin by comparing two factors: Baiyin's annual output value against Gansu's output value per employee.透过比较甘肃省各优先发展产业每个雇员平均产值与白银的年产值，得出白银预估就业人数
- As a result the total number of direct employees in Baiyin is derived for the same industries 因此在白银市直属员工总数可推导出
- Total number of direct employees increase from 15,710 to 380,105 or 24x 得出之直接雇员总数从15,710增加至380,105,即24倍的增长。
- Showing strong potential for economic transformation 显示出强大的潜力，经济转型

Case Study Findings – Planning Parameters 案例借鉴点－规划参数

LIP New Employee Demand Penetration by Industry LIP新员工的需求渗透？按行业	2020	2030	2033
Non-Ferrous Metals	3,578	4,254	5,124
Equipment Manufacturing Industry	892	2,098	2,965
Rare-Earth Products & Building Materials Industry	2,223	6,705	9,785
Coal Chemical Products	16,209	33,188	38,850
High-Quality Processing of Bases and Materials	502	1,104	1,442
Utilities Production	4,298	8,462	11,079
Cumulative Penetration	**27,702**	**55,812**	**69,245**

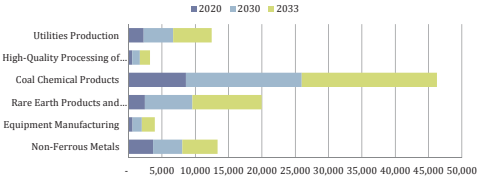
- An estimated 28,000 in 2020 and 56,000 in 2030 new industrial workers are captured by LIP估计LIP在2020年能吸引28,000个工人，2030年有56,000个

Summary of Planning Parameters	Ave. LIP Popn/Ha.	Benchmark Employee/Ha	Assumed Popn or Employee/Ha
Non-Ferrous Metals	10	80-200	20
Equipment Manufacturing	45	50-110	50
Rare-Earth Products and Building Materials Industry	19	40-170	20
Coal Chemical Products	20	100-120	50
High-Quality Processing of Bases and Materials		25-70	25
Utilities Production		20-40	10

- Benchmarks of industrial parks by industry type were reviewed to derive some planning parameters on employees per hectare工業園區按產業類型的基準進行檢討，以得出每公頃員工數量規划參数
- Summary of metrics of total employees per hectare from existing locators at LIP and from selected benchmarks:從LIP現有的入驻企业和從選定的基準公頃，得出每公頃的員工總數的指標

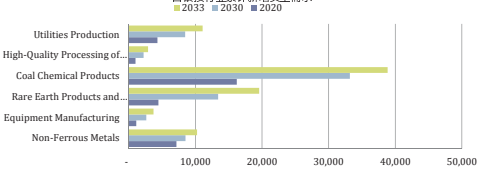
Incremental and Cumulative Increase in Direct Employment 直接就业增量与

Baiyin Incremental Increase in Direct Employment by Industry Sector 白银按行业直接就业人数年增量



- It is useful to determine the new incremental demand per year .重要的是要確定每年新增加的需求
- Estimates reveal annual demand for new employees with the development of Baiyin's industrial parks 估計值会顯示每年新員工的需求量，隨着白銀工業園區的發展

Baiyin Cumulative Increase in Direct Employment by Industry Sector
白银按行业累计新增员工需求



- The cumulative new demand for employees for the selected industries in Baiyin is summarized below: 白银的選定行業累計新增員工需求如左图所示

END

完

亚行贷款甘肃白银市城市发展二期项目

Gansu Baiyin Urban Development II Project by ADB

启动会议及 PPP首轮座谈会

Kick Off Meeting & PPP Inception Workshop

汇报人: AECOM Consultancy Team

日期: 27-28/05/2014

项目启动 Project Inception

启动阶段工作 Schedule of Kick-off meeting & Inception workshop

日期 (Date)	与会人 (Participant)	会议召开内容 (Agenda)
27/5/2014 (pm)	•ADB & BMG/LIP •PPTA & PPP Team	**启动会议** (Kick off Meeting) 1. PPTA, PPP 与LIP工作组对接 (Interfacing among PPTA, PPP & LIP) 2. PPP计划的启动会议，明确BMG/LIP的期望和此次项目的目标 (Kick off PPP scheme and Indentify the expectation and the goal of the project) 3. 明确BMG/LIP与PPP工作组的联络人 (Appoint the coordinator from both sides) 4. 现场调查 (On-site due diligence) 5. 资料收集 (Information Collection) 6. PPP 简介(Introduction of PPP).
28/5/2014 (am)	•ADB & BMG/LIP •PPTA & PPP Team	启动座谈会 (Inception Workshop) 1. 介绍各种PPP模式及白银项目的需求 (Introduce various PPP model and the requirement of the Baiyin Project) 2. 提出疑问及交流 (Questions & Answers)

Industrial Demand Analysis: Part 2 工业需求分析 （2）

Case Study Findings – Planning Parameters 案例借鉴点 – 规划参数

Industrial Land Use Requirements In Hectares工业用地需求 在公顷	LIP Locator Interview访谈		Industrial Demand Assessment工业需求分析			Balance Un-accounted Demand平衡或 取消占需求		
	2020	2030	2020	2030	2033	2020	2030	2033
Non-Ferrous Metals	300	530	179	213	256	(121)	(317)	
Equipment Manufacturing Industry	20	430	18	42	59	(2)	(388)	
Rare-Earth Products and Building Materials Industry	350	750	111	335	489	(239)	(415)	
Coal Chemical Products	310	310	324	664	777	14	354	
High Quality Processing of Bases and Materials	-	-	20	44	58	20	44	
Utilities Production/ Renewable Resources	-	-	430	846	1,108	430	846	
Total Industrial (in Hectares)	**980**	**2,020**	**1,080**	**2,140**	**2,750**	**100**	**120**	**730**

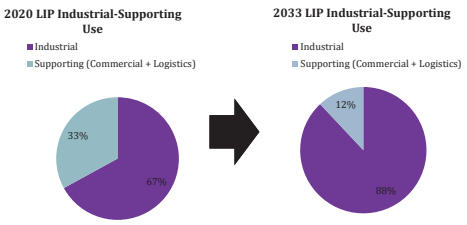
- Based on interviews with locators and on planning metrics, total industrial land demand is derived by industry sector.根據與选址者访谈与規劃指標，得出按行业全部工業用地的需求
- Logistics and warehousing are estimated as an additional 3%-5% of total Industrial park development 物流和倉儲估計為總工業園區額外的3%-5%。
- Service areas are estimated as an additional 8%-10% of total industrial park development. 服務區域估計为工業園區額外的8%-10%

Comparative Land Requirements – Locator versus Market Demand 土地需求比较 – 位址 v.s. 市场需求

Industrial Land Demand Requirements 工业用地需求条件

Liuchuan Industrial Park Development Program	23 SqKm Existing Plan		Land Demand Assessment					
	2020		2020		2030		2033	
Land Use	%	Hectares	%	Hectares	%	Hectares	%	Hectares
Industrial	39%	890	47%	1,080	43%	2,140	53%	2,750
Logistics/ Warehouse (3%-5% of industrial areas)	13%	308	2%	43	2%	86	2%	110
Service Areas (8%-10% Admin, Civic, Services)	10%	219	4%	90	4%	178	4%	229
Water Bodies/Mountains	25%	575	25%	575	12%	609	12%	609
Roads and MP Parks	13%	308	13%	308	13%	670	13%	697
Expansion/Other Use Areas			9%	204	26%	1,317	15%	805
LIP Land Use Program	**100%**	**2,300**	**100%**	**2,300**	**100%**	**5,000**	**100%**	**5,200**

- Demand is factored into total 52 square kilometer site and its phased development across 2020, 2030 and 2033. 总土地需求为52平方公里，分成2020年，2030年和2033年三阶段階段性發展
- Industrial land demand is expected to change with time but consistently >40%. And industrial, warehousing/logistics and service areas ~50% to 60% of total land development. 工業用地需求預計將隨著時間而改變，但持續>40%。工業，倉儲/物流和服務領域約占50%至60%的總土地開發，
- The total area allotted for residential development is 805 hectares starting with an initial 205 hectares in 2020.分配給住宅開發的總面積為805公頃，初期开发为205公頃，始於在2020年。



Industrial Sector Assessment 产业评估

Industrial Development Phasing 工业发展分期开发

Population	23 SqKm Existing Plan (Popn.Est.)		Locator Interviews (Popn.Est.)		Land Demand Assessment (Popn. Est.)		
	2020	2030	2020	2030	2020	2030	2033
Daytime - Worker Population	**46,000**	**92,345**	**46,440**	**92,699**	**36,618**	**73,480**	**91,949**
Industrial Worker Population	38,000	79,745	37,400	78,859	27,702	55,812	69,245
Logistics/ Warehousing Worker Population	*4,000*	*4,200*	*3,040*	*3,040*	*1,728*	*3,424*	*4,400*
Service Worker Population	*4,000*	*8,400*	*6,000*	*10,800*	*7,188*	*14,244*	*18,304*
Nighttime - Resident Population					**36,012**	**72,555**	**90,018**
Industrial Workers Living On-Site (assumes 65% of industrial workers & their families live on-site)					18,006	36,278	45,009
No. of On-Site Households (assumes 1.5 workers per household)					12,004	24,185	30,006
Total Nighttime Population (assumes average household size of 3)					36,012	72,555	90,018

- Assumed that logistics/ warehousing will have a worker population of about 40 to 50 persons per hectare假定物流/倉儲每公頃約40至50人的工作人口
- Service areas (including civic, government offices, etc.) are estimated to have about 80 to 100 persons per hectare. 服務領域（包括公民，政府機關等），估計有每公頃約80至100人。
- Given these assumptions, the total daytime and night-time population can be estimated.根據上述假定，可估算總的日間和夜間的人口。
- Out of the total industrial workers, it is estimated that approximately 65% of total employees will be working and living on-site with their families 在總產業員工中，據估計，估員工總數的約65%將工作和與家人住在区内
- Where the average worker per household is 1.5 and the average household size is 3.平均每戶職工數为1.5，平均家庭規模为3人，
- The estimated population size for LIP is between 36,000-39,000 in 2020, between 73,000-79,000 in 2030 and about 90,000-98,000 at full development – during the night time or daytime. 估計人口規模到2020年為36,000-39,000之間，2030年为73,000-79,000，全面发展后达90,000-98,000 - 在夜間或白天.

工作任务 Mission of the Project

PPP团队的工作目标 Tasks of PPP team

The mission of the PPP team:

(a)To conduct technical, financial, legal and commercial due diligence;

(b)To provide a training and an advise for the BMG/LIP to identify an appropriated PPP scheme;

(c)Identify and advise appropriate commercial and financial structure;

(d)To provide the draft outline of the Service Contract & Bidding Document of the Project;

(e)To assist LIP staff to conduct a market sounding and bid evaluation process of project;

PPP的团队的使命：

(a) 进行技术、财务、法律和商业尽职调查;

(b) 向BMG/ LIP提供培训和咨询，以便确定适合的PPP方案;

(c)确定并建议适合的商业和财务结构;

(d) 提供项目的服务协议和招标文件的纲要草案;

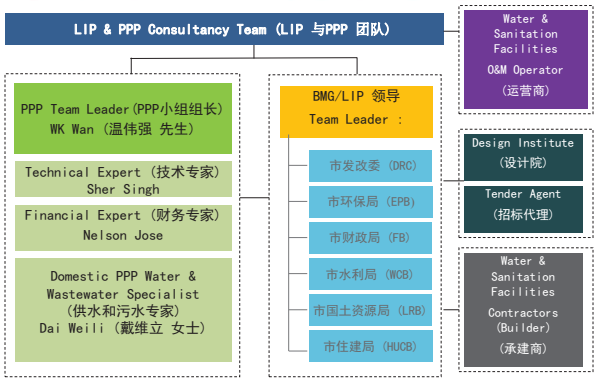
(e)协助LIP人员进行对外公告和投标评审过程;

启动会议Kick off meeting

Part ONE

Kick Off Meeting

团队组织 Team Organization



启动会议Kick off meeting

启动会议议程 Agenda of Kick off Meeting

1. 项目背景及任务
   (Project background and its mission)
2. 团队组织
   (Team Organization)
3. 项目工作计划
   (Project Work Plan)
4. 资料收集 、尽职调查 、 现场考察
   (Data Collection, Due Diligence &, Site Visit)

项目发展Project Development

下一步工作思路 Idea of the Work Plan

1. **预备工作**
   收集数据，结合当地政府的意见去确立未来的行动计划及工作路线。
2. **确立可行的PPP模式**
   通过财务、技术、机构及法律观点去分析各种可行的PPP 模式 ，协助当地政府确立合适的方案和结构。

1. **Preparatory**
   To collect data for assess various options and incorporate the opinion from LIP to identify the mission schedule and build up action plan.
2. **Defining the appropriated PPP model**
   To analyze various PPP models based on financial, technical, institutional arrangement & legal assessment and advise an appropriate scheme & structure for LIP consideration.

总体背景 Background of the Project

项目背景 General Introduction about the Project

Asian Development Bank (ADB) supports a Public-Private Partnerships (PPP) for a Operation and Maintenance Service Contract (O&M) of the planned water supply and wastewater facilities and the proposed reclaimed water system serving the Liuchuan Industrial Park (LIP).	亚洲开发银行（ADB）支持以公私合作（PPP）方式建立运行和维护服务合同（O&M）为计划建设的刘川工业园（LIP）供水和污水处理设施提供营运管理服务，並建议向园区内用户提供再生水供应。
The facilities shall be comprised: (a)a new water supply facility with treatment capacity of 60,000 cubic meters per day, a 14-km water transmission pipeline, a 13.97-km water distribution pipeline network and other related facilities; (b)a new wastewater treatment facility with treatment capacity of 35,000 cubic meters per day, a 57-km wastewater collection pipeline network and related facilities;	这些设施应包括： a) 一座新建日处理量60000立方米的净水厂、14公里输水管线、13.97公里的配水管网及其他相关设施; b)一座新建日处理量35000立方米的污水处理厂、57公里的污水收集管网及相关设施;

首轮座谈会Inception Workshop

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Part TWO

PPP Scheme

项目发展Project Development

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下一步工作思路 Idea of the Work Plan

3. 采购
确定政府与私企的服务范围和职责，协助当地政府制定项目要求、拟订协议的纲要草案及招标文件。

4. PPP 方案的执行与监督
协助当地政府组织对外公告、招标、评标及过程监督以保证设施得到有效的使用。

3. Procurement
Define the scopes of service, the responsibility between Public & Private parties and assist LIP to specific the project requirement, draft the service contract & bidding document.

4. Implementation & Monitoring
To assist LIP to conduct market sounding, bidding process, bid evaluation and monitor the whole process to ensure the facilities to be proper used.

首轮座谈会(Inception Workshop)

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目录Table of Contents

1. PPP模式介绍 (Introduction of PPP)

- PPP模式结构及案例 (PPP Structure & Selected Cases)
- 市场的主要营运商 (Key player/operator in the market)

2.白银项目的PPP 计划(Baiyin PPP Scheme)

- 白银项目的需求 (Need/ Requirements of Baiyin Project)
- 托管运营模式介绍 (Describe Various O&M options)
- 法律 、 技术 、 营运及财务的各种考虑要素
  (Considerations on legal, technical, operational and financial components).

建立共识与培训 Consensus Building & Training

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主题 (Topic)	培训内容 (Key content)	项目阶段 (Stage)	建议参加人员 (Participant)
探讨各种PPP模式 (Identify various PPP scheme)	介绍PPP的基本概念和操作过程 探讨本项目的需求和可行的模式 Introduce the principles of PPP its implementation; Identify the need and the feasible structure of this project.	启动阶段 Inception Workshop	BMG/LIP 项目小组
确立适合的PPP模式 (Defining the appropriate PPP scheme) **PPP方案执行 (Project Execution)**	从技术、财务、商业运作进行分析 确立适合本项目的可行模式 介绍招标文件及服务协议纲要草案; Conduct technical, financial, commercial analyze. Define an appropriate scheme; Introduce the principles of the service contract & bidding document; 总结方案及制定目标计划 确立项目的执行日程及工作 Conclusion & develop the mission schedule; Define the implementation program and work plan	终期阶段 Final Workshop	BMG/LIP 项目小组

公私合作伙伴(PPP)模式

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公私合作模式的定义及原则（Definition & Principles of PPPs)

定义：PPP是一种公共机构与私人企业的协作方式
Definition: PPP is a public and private sector collaborative approach, its principles are the :

❖当政府或政府相关的**公共机构与私人营运商成为合作伙伴**为公众提供公共服务时，就形成了公私合作模式或公共事业场化（PPP)。

❖ A public private partnership (PPP) is formed when a public entity, such as a government or a government-related agency, partners with a private company operator to provide public services for its inhabitants.

❖由于各地区发展和需求不一，所有PPP模式都可通过量身定制来达到期望。

❖ All PPP's are tailor-made to fit expectations

尽识调查 Due Diligence

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资料收集 Information Collection

Activities 活动内容	LIP Team	PPP Team
Questionnaire/ Q&A 问卷/答疑		28-May 提交 Submitted on 28-May
Site Visit 现场考察		温伟强, Sher, Nelson, 戴维立
Coordinator/ Contact Person 联系人		戴维立

公私合作伙伴(PPP)模式

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公私合作模式的效益 (Benefits of use PPPs)

6. 使财务预算达到概定的结果。
7. 提高资产利用率和社会经济效益。
8. 可持续发展和改进监管。
9. 公共机构只交付达到约定绩效的服务。
10. 引入私人机构的资本。

6. Deliver certainty of budget & outcomes.
7. Better asset utilisation & social economic benefits.
8. Sustainable development & improved regulation.
9. Public sector only pay when services are delivered.
10. Injection of private sector capital.

公私合作伙伴(PPP)模式

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公私合作模式的原则（Principles of PPP scheme)

是一种公共机构与私人企业的协作方式
(a public and private sector collaborative approach)：

❖PPP模式通常持续15至30年，因为涉及：
- 运营商的长期承诺
- 员工培训和诀窍转让

❖政府和私人运营商的责任通过合同约定可得到更明确的责任和义务。

❖在合同期结束时，政府可选择收回运营项目、续签合同或变更业务范围。

❖ A PPP usually lasts from 15 to 30 years, because it involves:
- long term commitments on service.
- Operator's training and know how transfer.

❖ The responsibilities between the public and the private party are clearly defined.

❖ At the end of the contract period, the public can take back the operation, extend or renew the contract, or change the scope of works.

公私合作伙伴(PPP)模式

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公私合作的角色分担（Roles of Public/Private sectors)

责任的分担：

	公共机构的责任		私营运营商的责任
资产的属性	➢所有权 ➢战略性城市规划	资产得到有效的监控 定期制订投资计划	➢运营、维护和更新 ➢投融资、设计和承建，从运营的角度为設施提供优化的方案
有关管理规例：（服务水平，技术要求等）	➢立法和监管 ➢制订要求	建立汇报、审计和服务标准，具有更高透明度	确保执行日常管理和工具符合标准
水/污水费	按价格政策审批	财务审计，依法执行调价程序	➢优化运营成本和资本成本 ➢提出调价申请
长期愿景	提高公共服务的效率，向用户提供更优质的服务 ➢ 减轻财政压力 ➢ 监管与营运专业分工 ➢ 增加透明度	通过订立的服务准则委托私人运营商 通过商业操作以履约形式达到期望的服务水平	使更有效率地提高员工积极性、员工培训、专业技术转让

公私合作伙伴(PPP)模式

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公私合作模式的目标 (Objectives of PPP scheme)

1. 减轻财政负担及克服政府融资难题
   (本项目起始设施的建设采用亚行贷款)
2. 强化政府在公共行政管理理念和监管的角色
3. 改善公用事业的运营效率、服务质量和透明度
4. 政府引导、财政支持
5. 企业主体、社会参与、市场运作

1. Optimize government's financial affordability on project financing. (The new investment of this project is funded by ADB)
2. Strengthen the role of government in public administration and supervision.
3. Improve the administration & the operational efficiency of utilities service on its quality and transparency.
4. Government guidance, financial support.
5. Enterprises body, social participation and market guiding.

公私合作伙伴(PPP)模式

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公私合作的角色分担（Roles of Public/Private sectors)

Share Responsibilities	Municipality responsibilities		Private Operator responsibilities
Assets	•Ownership •Strategic City Plan	Monitoring & regular discussions on investment plan	•Operate, Maintain & Renew •Design & Construction
Regulations: (level of service, water quality, etc…)	•Definition & Monitoring •Specific requirement	Transparent reporting & audits Review of performance criteria	Implementation of management & tools to ensure compliance
Water Tariff	Approval in line with price policies	Financial audits Price increase procedure in accordance with law	•Optimize Opex & Capex •Request for tariff increase
Long Term Vision	•Develop efficiency public service and first class citizens •Optimize financial affordability •Highly transparency.	Delegation of services to a qualified private foreign operator	Efficient organization & management, incentive staff , staff training and transfer of Know How

公私合作伙伴(PPP)模式

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公私合作模式的效益 (Benefits of use PPPs)

1. PPP 方式可优化财务负担。
2. 采购程序简便， 加快项目实施的效率。
3. 在一个特定时间内，加快项目的交付及所其绩效。
4. 着眼于绩效。
5. 风险分配给最有能力管理风险的一方。

1. PPPs make projects affordable.
2. More efficiency in procurement.
3. Faster project delivery with more projects in a defined timeframe.
4. Focus on outputs & performance.
5. Risks are allocated to the party best able to manage the risk

公私合作伙伴(PPP)模式

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公私合作模式---融资性质（PPP---Financial Base）：

合作方式：

BOT模式 (建设-运营-移交)

- 私营企业负责新建设施的投融资、设计和运营。
- 私营企业负责处理设施的运营管理。
- 政府按协议支付定额定量服务费 (“ToP”--必购必付)。
- 合同期内的资产属私营者，约满移交公营部门。
- 一般合同期>25年，合同期满时将设施移交还给政府 。

BOT (Build , Operate & Transfer)

- Private sector responsible for O&M of treatment plant
- Private sector responsible for all new capital investment.
- Public sector pay service fee according to ToP—Take or Pay;
- Assets owned by private sector during the contract period, and then are transferred to the public sector.
- Long-term contract (> 25 years).

公私合作伙伴(PPP)模式

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公私合作模式的绩效标准 (Key Performance Indictors for non financial aspects)

1. 达标质量, 如水质、供水中断频率、 水压、没发生污染等。
2. 与政府机构的通报与回应， 如新的标准，运营报告等。
3. 服务承诺，如，响应客户的要求与投诉、附加值等客户服务

1. Achievement of quality, such as Water quality, Water supply interruption, water pressure, no pollutions etc.
2. Communication/Responding with Government Agency, such as new standard, operational report etc;
3. Commitments of service, such as responds of customer, requesting, complaints, value added service and so on.

公私合作伙伴(PPP)模式

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公私合作模式---融资性质（PPP---Financial Base）：

合作方式：

AOT模式 (收购-运营-移交)

- 技术要求及服务的质量保证由双方签署服务协议，其中双方同意定额定量折算费用 、 设施资产的折旧和融资等均在协议当中加以规定
- 资产移交或续签合同：合同期满， 政府可选择回购资产，或者续签合同。
- 合同期内的资产属私营企业。
- 一般合同期>10年，合同期满时将设施移交还给政府 。

AOT (Acquisition, Operate & Transfer)

- Technical & service quality assurance defined by services agreement signed by both parties, which the parties agreed on fixed fee against fixed quantity of costs, depreciation of assets and financing facilities to be specified on the agreement.
- Assets transfer & contract renewal: the government can buy-in the assets, or renew the contract when the contract expires.
- Assets belongs to private enterprise during the contract period.
- Contract period>10 years, he facility will be hand over to government when the contract expires.

公私合作伙伴(PPP)模式

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公私合作模式的目标 (Successful factors on PPPs)

1. 政治意愿
2. 政府的承诺
3. 清晰明确的要求
4. 恰当的风险共担
5. 物有所值
6. 绩效管理

1. Political will
2. Government commitment
3. Clear output specification
4. Appropriate risk sharing
5. Value for money
6. Performance management

公私合作伙伴(PPP)模式

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公私合作模式---非融资性质（PPP---NON Financial Base）

合作方式：

DBOM模式 (设计-建设-运营管理)

- 私营企业负责新建设施的设计、建设、运营和维护。
- 政府承担所有设施的投资 。
- 合同期内的资产属政府 。
- 一般合同期>12年，合同期满时将设施移交还给政府 。

DBOM (Design, Build, Operate & Maintenance)

- The private sector is responsible for the new facility design, construction, operation and maintenance.
- Government's commitment to invest in all facilities
- Assets owned by Government within the contract period.
- Contract period > 12 years as usual, to transfer the facility back to the government when the contract expires.

公私合作伙伴(PPP)模式

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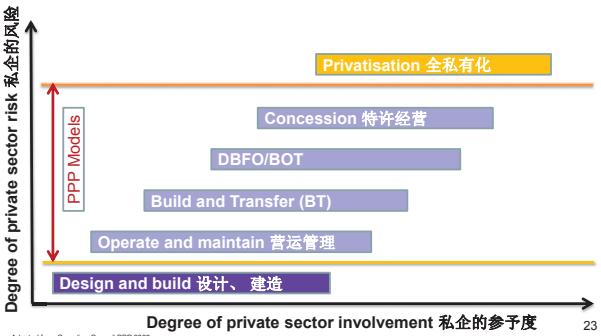
各种公私合作模式（Range of PPPs）：



Adapted from Canadian Council PPP 2009

公私合作伙伴(PPP)模式

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私企责任 Responsibilities of Private Sector：

	BOT BOT	Concession 特許经营	Lease 租赁	O&M 托管合同
Assets ownership 资产拥有	During contract 合同期内	Yes/No 有(新)/没有	No 没有	No 没有
Investments投资	All (+Build) 所有(新建)	All 所有	Renewal if necessary 更新(如需)	No 没有
Operation and maintenance营运管理	Treatment Plant (TP) 一般只有处理厂	All 所有	TP to all 厂/所有	TP to all 厂/所有
Duration (years) 服务年期	> 25	>25	10 - 20	5

公私合作伙伴(PPP)模式

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公私合作模式---非融资性质（PPP---NON Financial Base)

合作方式：

- 私营机构负责营运及维护：包括处理厂及所有其他服务
- 私营机构不负责任何投资
- 营运及维护合同 ~5年

托管 (DM): (Operate & Maintenance Contract)

财务 ：优化用于为水务基建及管理提供资金的公/私营债务组合
营运 ：调整服务目标, 包括客户关系、人力资源、技术方案、发展等
期内 ：暂时性、具透明度及可回复性
效率 ：政府专注法规制定, 而私营机构则专注服质量

- Private sector O&M responsibility : from treatment plant only to all services
- No private investment.
- Short-term O&M contract ~5 years
  - **In financing** : optimum combination of public-private debt rations in financing water infrastructures and management
  - **In operation** : adapted service targets, including customer relations, human resources, technical solutions, development …
  - **In duration** : temporary, transparent, and reversible
  - **In efficiency** : public sector focuses on regulations, and private sector on service performance

Delegated management : O&M contract

公私合作伙伴(PPP)模式

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公私合作模式执行步骤（PPP implementation process)

Defining the needs 需求界定	Defining the service 服务界定	Contracting 起草、签订协议	Commissioning 调试	Managing the partnership 战略伙伴关系管理
•功能界定 •现有设施运行效果和运行维护费基线评估	•服务内容的确定 •进行详细的可行性研究，并根据结果对服务范围和标准进行调整 •编制技术和商务方案	•根据具体项目起草、签订具体的协议 •双方职责界定	•运营移交 •人员移交 •职责移交	•建立基于双方责任的沟通机制 •共同成立指导委员会 •持续改进

公私合作伙伴(PPP)模式

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公私合作模式—合作（PPP---Cooperative)：

合作方式：

租赁

- 私营企业与政府协议负责对约定范围的设施执行运营管理。
- 合同期内资产由政府持有，私营者负责资产的更新维护、新增资产由政府投资。
- 服务费向终端用户收取。
- 一般合同期10-20年，合同期满时将设施移交还给政府 。

Leasing

- Private sector O&M responsibility : from treatment plant only to all services
- Major capital investment is a public responsibility and the assets remain public sector property, private sector responsible for renewals
- Direct bill the tariff charge to customers.
- Middle-term contract (10-20 years)

公私合作伙伴(PPP)模式

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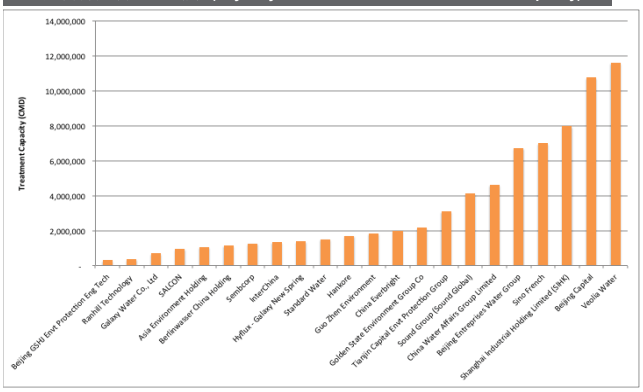
主要的水务营运商 -- 处理能力(Key Player in the Water Market—Treatment Capacity)



公私合作伙伴(PPP)模式

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公私合作模式—合资（PPP---Joint Venture)：

合作方式：

特许經营

- 私营企业通过政府授权负责对约定范围的设施执行运营管理。
- 合同期内现有资产继续由政府持有，私营者负责新增资产的投融资，设计和运营。
- 服务费向终端用户收取。
- 一般合同期>25年，合同期满时将设施移交还给政府 。

Concession

- Public authorizes the concession right to a private enterprise tor responsible all the O&M services within the service area.
- Assets remain public sector property or transferred temporarily to Project Company, private enterprise shall responsible for all O&M (customer service included) & all capital investment during the contract period.
- Direct bill the tariff charge to customers.
- Long-term contract (> 25 years)

1. 供水服务特许经营 Concession

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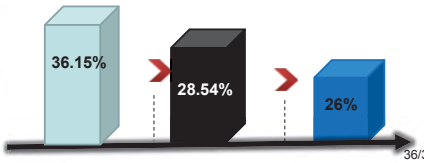
降低产销差

- 涉及产销差56项因素，制定措施，跟踪落实
- 自检与第三方检漏相结合
- 水表普查
- 二次加压站溢流控制
- 自用水自检自查
- 加强违章、违规用水巡查力度
- 实施管网更新改造



公私合作伙伴(PPP)模式

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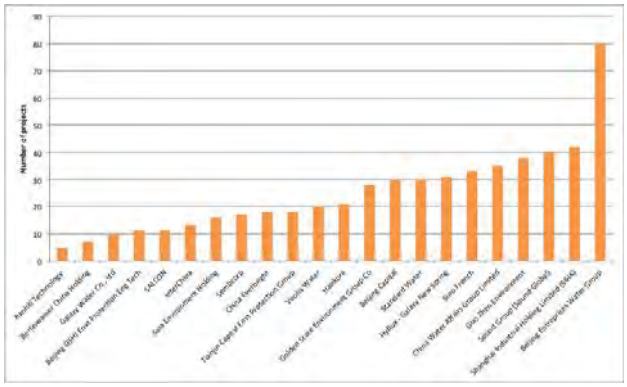
主要的水务营运商 -- 项目数量(Key Player in the Water Market—Nos. of project)



1. 供水服务特许经营 Concession

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水质监测中心

- 具备169项检测能力

客户服务中心

- 公司成立后，实施二次客户服务软件管理系统升级改造
- 每天平均受理 500个左右的来电
- 客户服务热线中心通过呼叫系统与13个远程站点相连

1. 供水服务特许经营 Concession

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项目简介

- 水务集团与投资者51/49股比成立合资公司
- 全资公司成立于2006年
- 服务范围：180平方公里
- 服务人口：250万人
- 处理总量为1,365,000立方米/日
- 运营期为30年

1. 供水服务特许经营

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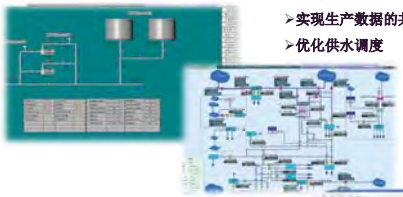
供水调度中心

新的SCADA系运行

- 采集生产全过程数据
- 实现生产数据的共享
- 优化供水调度



地理信息系统（GIS）

实现管网基础资料的动态管理

- 实现管网分析
- 实现数据共享

水力模型

实现生产供水的模拟

1. 供水服务特许经营 Concession

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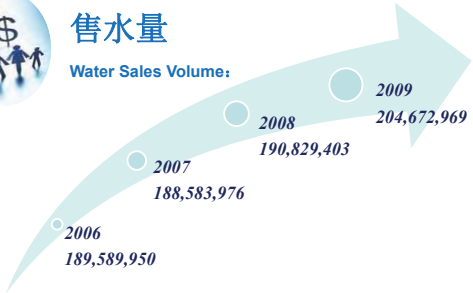
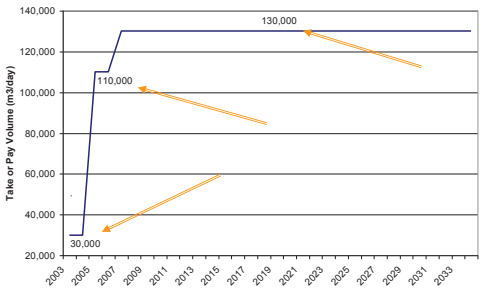
售水量

Water Sales Volume：



2.BOT+TOT



必购必付水量(ToP):

若实际水量少于约定水量，市政府购买每月约定的最低水量(设计处理量的80%);

2.BOT+TOT

北区污水厂 : BOT, 50,000 m³/day, 2005年1月投产

香洲污水厂 I 期 : TOT,特许经营, 30,000 m³/day, 2002年底移交

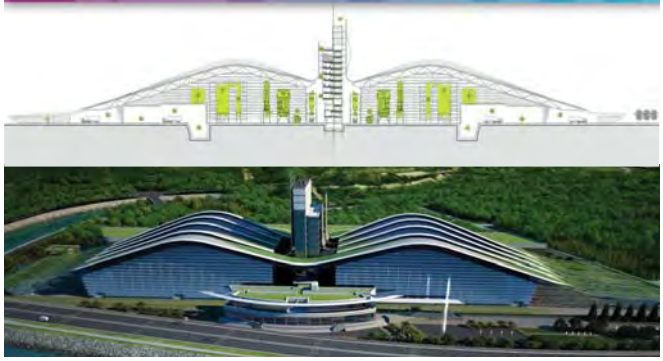
香洲污水厂II 期 : BOT, 50,000 m³/day, 2005年1月投产

合约期：共32年，

包括新建污水厂的2年建设期

STP : Sewage Treatment Plant

3. DBOM 设计-建造-运营



香港每天处理2000吨污泥焚烧发电项目• 零污染 零排放

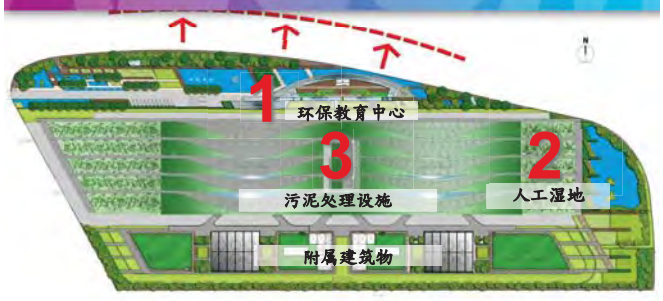
设计、建造 + 15年运营

2.BOT+TOT

- 合同期: 30年营运2005 – 2035
- 建设期: 2年全面建设香洲二期及北区污水厂2003及2004
- 移交:现有香洲一期由2003年移交营运

- 开始营运现有香洲一期污水厂
- 开始建设香洲二期污水厂
- 全面营运及拥有资产
- 必需符合达标排放
- 总体规模130,000m3/天

3. DBOM 设计-建造-运营

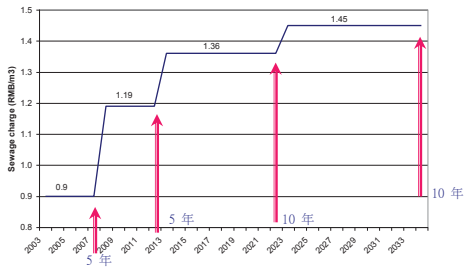


建筑布局

土地分配 • 三个主要用途，三个主要分区

最佳方位及景致 • 以南北轴线作为设计主轴

2.BOT+TOT



收费结构:

排污费将由政府支付， 并按照通账、外汇波动、公用开支、劳动成本等作出调整

首轮座谈会Inception Workshop

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Part THREE

PPP Scheme

4. DM (O&M) 托管（运营管理合同）

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海南省16市县污水处理厂委托运营

1. 17座厂均自2008年动工，计划2009年底前投入运营
2. 各市县此前没有任何污水处理厂，也没有相关的技术和管理人员，甚至政府水务管理部门也缺少监管力量，各市县各自运营将遇到困难
3. 17座厂均系中央财政、省财政和地方财政三方投资，无法以BOT/TOT方式引入投资者，只能进行委托运营（不改变产权关系）
4. 因为处理能力偏小，任何一个厂对外委托运营均存在不足：一是各市县没有能力组织委托运营招商；二是单个厂的委托运营服务费将偏高；三是单个项目运营收入低，对有实力的运营商缺少吸引力

白银项目的PPP 方案 Baiyin PPP scheme

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白银供水及污水处理项目的内容
(Scopes of the Baiyin Water and Sanitation Project)

4. DM (O&M) 托管（运营管理合同）

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		海南省新建的17个污水处理厂	New 17 STPs of Hainan
1.	规模 Treating capacity	两个项目处理能力分别为14.1万吨/日和14.2万吨/日	141,000m3/d for 8xSTPs 142,000m3/d for 9xSTPs
2.	运营期 Duration	5年	5 years
3.	服务范围 Scopes of service	调试+运营	T&C+O&M
4.	进水标准 Influent standard	入城镇排水管网并进入污水处理厂的工业废水、医疗废水和生活污水等污废水的水质按照国家规定均达到《污水综合排放标准》（GB8978-1996）和《污水排入城市下水管道水质标准》（CJ3082-1999）的相应规定限值要求。	"Integrated Wastewater Discharge Standard" (GB8978-1996), and "sewage discharged into the urban sewer water quality standards "(CJ3082-1999) corresponding to the requirements specified limit.
5.	出水标准 Treated standard.	《城镇污水处理厂污染物排放标准》(GB18918-2002)一级B标准；	"Urban sewage treatment plant pollutant discharge standard" (GB18918-2002) a B standard;

白银项目的PPP 方案 Baiyin PPP scheme

AECOM

白银供水及污水处理项目的内容和需求
(Needs of the Baiyin Water and Sanitation Facilities)

一座日处理量60,000m3/d的市政供水厂	a new 60,000m3/d treatment capacity of water supply facility.
14公里长的原水输水管线、13.97公里的供配水管网与相关设施；	a 14-km raw water transmission pipeline, a 13.97-km water distribution pipeline network with related facilities;
一座日处理量35,000m3/d的市政污水处理厂	a new 35,000m3/d treatment capacity of wastewater treatment facility.
40.035公里长的污水收集管网与相关设施；	a 40.035-km wastewater collection pipeline network with related facilities;
其他： a) 污泥处置； b) 再生水利用； c) 园内的个体工业客户。	Others : (a)Sludge disposal scheme; (b)Recycling Water; (c)Services for Individual Industrial customers.

4. DM (O&M) 托管（运营管理合同）

AECOM

		海南省新建的16个污水处理厂	New 16 STPs of Hainan
6.	收费结构 Payment	起始保底水量按设计水量的65%，其后每年最少5%增加至85%封顶。	Min. 65% of treating volume in first year, at least 5% increase in progressive years, Max. 85%
7.	调价准则 Rebasing	• 包括电费、药剂费、员工工资福利费、污泥处置费、政府规费、税费； • 当污染物排放标准提高导致处理成本增加时，重新核定污水处理服务费。	•Including electricity, chemical, employee wages welfare, sludge disposal fees, administration fees, taxes; •When the discharge standards upgraded, cause the treatment costs to be increased.
8.	项目交接 Handover	• 运营商负责调试，费用由承包商及政府负责； • 当项目到期时，运营机构无偿移交项目全部资产	•The operator responsible for commissioning, the cost paid by the contractor and the government; •When the contract expires, the operators free handover of all assets

白银项目的PPP 方案
Baiyin PPP scheme

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PPP考虑因素

5. 风险分担：
   - 赔偿/ 罚款
     - 履约保函
     - 延期罚款
     - 未达标赔偿
   - 法律法规的变更；
     - 预设不可预见成本；
6. 人力资源：
   - 身份变更；
   - 现有员工移交
   - 员工培训；

1. **Share Risk:**

   Compensation /penalty
   -Performance bond.
   - Delay penalty;
   - Incompliance penalty;

   Change in law/Regulation
   - Contingencies

2. **Human Resource:**

   - Employment status;
   - Current staff transfer;
   - Staff training;

白银项目的PPP 方案
Baiyin PPP scheme

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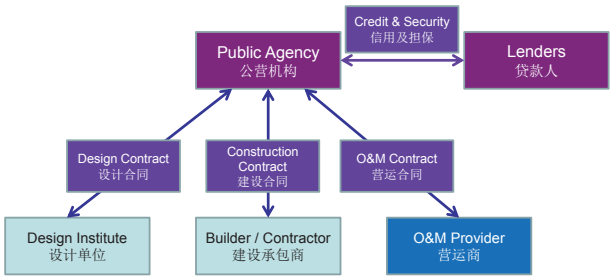
白银供水及污水处理项目结构
(Structure of the Baiyin Water and Sanitation Project)



白银项目的PPP 方案
Baiyin PPP scheme

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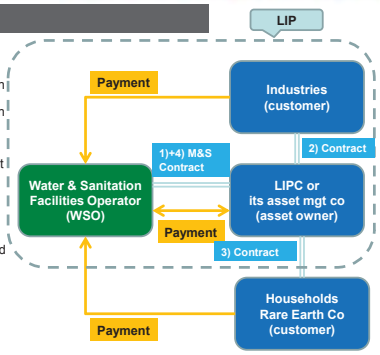
Option 1. (O&M)

1. Contractual & Ownership:
   1) O&M existing W/WWTP in LIP;
   2) Water supply contract sign between LIPC & ind.customer
   3) Water supply contract sign between LIPC & Households of RDC and future new customer.
   4) LIPC delegates WSO to collect the tariff from the customer and deposit into LIP's bank account.
2. Key factors：
   - The obligations of WSO would be taken the task specified by LIPC.
   - Different level tariffs may be applied inside/outside the LIP
   - Capex & opex pipeworks & new investment by LIPC.
   - Demand Risk on LIPC.
   - No investment by WSO.
   - Fixed scopes of services Vs fixed fee.



白银项目的PPP 方案
Baiyin PPP scheme

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PPP考虑因素（Key Considerations）

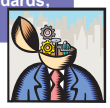
1. 设施的移交
   (Transition of DB→O&M)：
   - 移交时间、方式及程序；
   - 移交的界面及准则；
2. 服务要求的界定
   - 服务范围及年期；
   - 界面-厂/ 厂网；
   - 服务标准及职能 ；
   - 移交的界面及准则；

1. **Facility Handover (Transition of DB →O & M):**

   - Handover duration, methodology and procedure;
   - Interface and standards;

2. **Defining service requirements**

   - Service scope and duration;
   - Interface - plant / network;
   - Performance and functions;
   - Transfer interface & standards;



白银项目的PPP 方案
Baiyin PPP scheme

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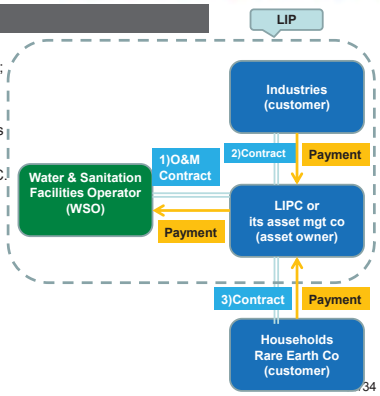
Option 2 (O&M)

1. Contractual & Ownership:
   1) O&M existing W/WWTP in LIP;
   2) Water supply contract sign between LIPC & ind.customer.
   3) Water supply contract sign between LIPC & & Households of RDC and future new customer.
   4) Customer pay the tariff to LIPC.
2. Key factors：
   - WSO only charge LIPC on O&M service fee;
   - The obligations of WSO would be taken the task specified by LIPC.
   - Different level tariffs may be applied on inside/outside LIP
   - Capex & opex on pipeworks & new investment by LIPC.
   - Demand Risk on LIPC.
   - No investment by WSO



白银项目的PPP 方案
Baiyin PPP scheme

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PPP考虑因素（Key Considerations）

3. 收费机制
   - 固定及/或可变费用
   - 必购必付(ToP)
   - 价格重定-包括通涨率、消费物价指数、间接运行成本等；
4. 设施投资
   - 技改设施；
   - 设施扩容；
   - 新增设施；

1. **Payment Mechanism:**

   - Fixed/Variable fee
   - Take or Pay Volume.
   - Rebasing, including inflation, CPIs, direct operating cost etc.

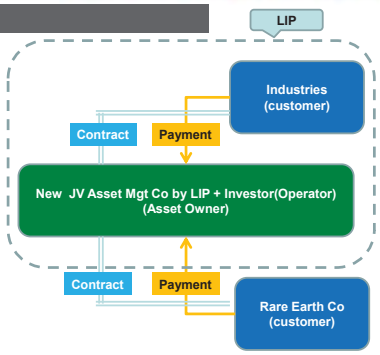
2. **Asset/Facility Investment:**

   - Standard/performance upgrade
   - Capacity expansion;
   - New facility;

白银项目的PPP 方案 Baiyin PPP scheme

Option 6. Concession

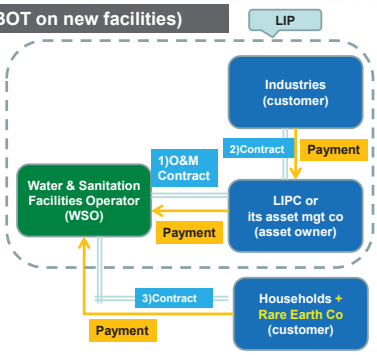
1. Contractual & Ownership:
   - Concession full water services within the service area by the JV.
   - Bill customer directly;
   - Sell water to REC or new customer.
2. Key factors：
   - Land Use Right;
   - LIP inject W/WW assets & investor invested by cash;
   - Service area could be extended in the future.
   - New investment by JV;
   - Demand Risk on JV.



白银项目的PPP 方案 Baiyin PPP scheme

Option 3. (O&M W/WWTP+BOT on new facilities)

1. Contractual & Ownership:
   1) O&M existing W/WWTP in LIP;
   2) Water supply contract sign between LIPC & ind.customer.
   3) WSO BOT for supply water to REC, Water supply contract sign between WSO & & Households of RDC +REC and future new customer outside LIP.
   4) Customer inside LIP pay the tariff to LIPC and LIP pay service fee to WSO.
   5) Customer outside LIP pay the tariff to WSO.
2. Key factors：
   - Different tariffs may be applied on the customer outside the LIP
   - Capex & opex pipework inside LIP by LIPC.
   - Partial Demand risk on WSO.
   - New investment by WSO



白银项目的PPP 方案 Baiyin PPP scheme

New Facilities & New Services

1. New Facilities:

- Build & Supply of Recycling Water;
- Sludge Disposal Facilities;

The investment will be taken by the party on the options as the new facilities.

2. New Service:

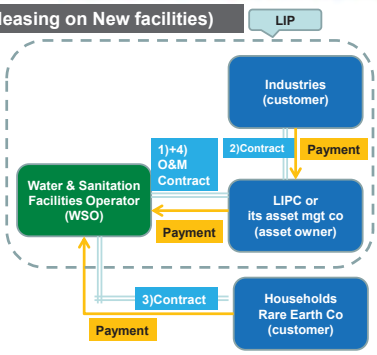
- BOT/AOT/EPC/O&M for the individual industrial customer on their pre-treatment facilities;

Freedom for WSO to their marketing and extend its service for individuals but the services should not be conflict with the service contract with LIPC.

白银项目的PPP 方案 Baiyin PPP scheme

Option 4. (O&M W/WWTP+ leasing on New facilities)

1. Contractual & Ownership:
   1) O&M existing W/WWTP in LIP;
   2) Water supply contract sign between LIPC & ind.customer.
   3) LIPC concession to WSO to supply water to REC, Water supply contract sign between WSO & & Households of RDC and future new customer outside LIP.
   4) Lease agreement for new facilities.
   5) Customer inside LIP pay the tariff to LIPC and LIP pay service fee to WSO.
   6) Customer outside LIP pay the tariff to WSO.
2. Key factors：
   - Different tariffs may be applied on the customer outside the LIP
   - New investment by LIPC.
   - Lease new facilities for WSO.
   - Partial Demand risk on WSO
   - No investment by WSO



阶段报告 Stages Reporting

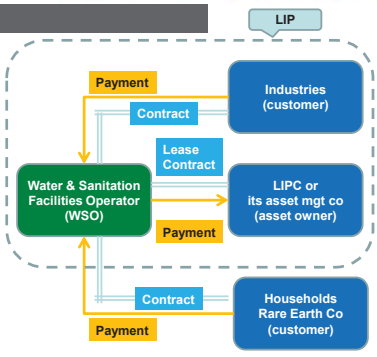
计划的工作日程 Planned Mission Schedule

日期 (Date)	与会人 (Participant)	会议召开内容 (Agenda of Meeting)
June/2014	•ADB & BMG/LIP •PPP Team	选项分析及编写报告 (Assessment & Draft Report) 1. 分析潜在的托管运营方案 (Analyze various feasible O&M options) 2. 介绍托管运营的合同条款; (Introduce the term sheet of O&M contract) 3. 计划下一步工作 (包括对外公告、招投标准备)。(Action plan on next phase, including market sounding, bidding process)
July /2014	•ADB & BMG/LIP • PPP Team	终期报告 (Final Report) 1. 提交、总结最终报告 (Submit & conclude the final report) 2. 执行工作计划(包括对外公告、招投标准备)。(Action Plan on next process, including market sounding, bidding process)

白银项目的PPP 方案 Baiyin PPP scheme

Option 5. (Leasing)

1. Contractual & Ownership:
   1) Lease contract sign between WSO & LIPC for existing W/WWTP
   2) WSO pay lease fee to LIPC;
   3) Concession agreement sign between WSO & LIPC;
   4) Water supply contract sign between WSO & ind.customer.
   5) Water supply contract sign between WSO & REC or new customer.
   6) All customer pay the tariff to WSO.
   7) WSO provides full water service including customer services;
2. Key factors：
   - New investment by LIPC
   - Demand Risk on WSO.
   - No investment by WSO.



工作计划 Work Plan

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计划的工作日程 Planned Mission Schedule

日期 (Date)	与会人 (Participant)	会议召开内容 (Agenda of Meeting)
Aug/Sep 2014	•ADB & BMG/LIP •PPP Team	对外公告(Market Sounding)
Dec /2014	•ADB & BMG/LIP • PPP Team	提交合同及招标文件纲要草案; (Submit Outline of Term sheet & bidding document)
EXT 2015	•ADB & BMG/LIP • PPP Team	评标及合同談判支援 (Supporting on Bid Evaluation and contract negotiation)

工作计划 Work Plan

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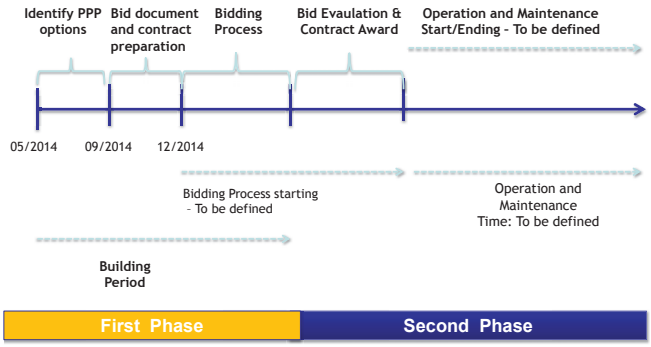
Preliminary Program Chart - 初步程序



Thank you!

谢谢！

Discussion is welcomed

欢迎大家踊跃讨论

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