Initial Environmental Examination (Draft)

Project Number: 42019-014
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People's Republic of China: Multimodal Passenger Hub and Railway Maintenance Project

Prepared by the China Railway Corporation for the Asian Development Bank.

CURRENCY EQUIVALENTS
(as of 1 June 2018)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.1558
$1.00	=	CNY6.4204

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	affected person
AQG	–	air quality guideline
ASEAN	–	Association of Southeast Asian Nations
BOD_5	–	5-day biochemical oxygen demand
BRT	–	bus rapid transit
C&D	–	construction and demolition
CKRC	–	ChengKun Railway Corporation
CO	–	carbon monoxide
COD	–	chemical oxygen demand
CRB	–	Chengdu Railway Bureau
CRC	–	China Railway Corporation
CREEGC	–	China Railway Eryuan Engineering Group Co. Ltd
DFR	–	draft final report
DO	–	dissolved oxygen
EA	–	executing agency
EHS	–	environment, health and safety
EIA	–	environmental impact assessment
EIR	–	environmental impact report
EIRF	–	environmental impact registration form
EIT	–	environmental impact table
EMP	–	environmental management plan
EMR	–	environmental monitoring report
EMS	–	Environmental Monitoring Station
EPB	–	Environmental Protection Bureau
EPD	–	Environmental Protection Department
EPL	–	Environmental Protection Law
ESE	–	environmental supervision engineer
FYP	–	five year plan
GDP	–	gross domestic product
GHG	–	greenhouse gas
GMS	–	Greater Mekong Subregion
GRM	–	grievance redress mechanism
IA	–	implementing agency
IEE	–	initial environmental examination
I_{Mn}	–	permanganate index
IPCC	–	Intergovernmental Panel on Climate Change
L_{Aeq}	–	equivalent continuous A-weighted sound pressure level
LAS	–	linear alkylbenzene sulfonate
LDI	–	local design institute
LIEC	-	loan implementation environment consultant

MEE	–	Ministry of Ecology and Environment
MEP	–	Ministry of Environmental Protection
MSW	–	municipal solid waste
N	–	nitrogen
NDRC	–	National Development and Reform Commission
NH_3-N	–	ammonia nitrogen
NO_2	–	nitrogen dioxide
NO_x	–	nitrogen oxides
O&M	–	operation and maintenance
P	–	phosphorus
PAH	–	poly-aromatic hydrocarbon
PAM	–	polyacryl amide
PAM	–	project administration manual
PCR	–	project completion report
pH	–	a measure of acidity and alkalinity
$PM_{2.5}$	–	particulate matter with diameter $\leqslant$ 2.5 μg
PM_{10}	–	particulate matter with diameter $\leqslant$ 10 μg
PMC	–	project management consultant
PME	–	powered mechanical equipment
PMO	–	project management office
PO_4^{2-}	–	phosphate
PPE	–	personal protective equipment
PPTA	–	project preparation technical assistance
PRC	–	People's Republic of China
RP	–	resettlement plan
SBR	–	sequential batch reactor
SEA	–	strategic environmental assessment
SO_2	–	sulfur dioxide
SPS	–	safeguard policy statement
SS	–	suspended solid
TA	–	technical assistance
TP	–	total phosphorus
TPH	–	total petroleum hydrocarbon
TSP	–	total suspended particulate
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
VOC	–	volatile organic compounds
WBG	–	World Bank Group
WHO	–	World Health Organization
WWTP	–	wastewater treatment plant

WEIGHTS AND MEASURES

$^{o}/_{oo}$	–	part per thousand
^{o}C	–	degree centigrade
cm	–	centimeter
dB	–	decibel
dB(A)	–	A-weighted sound pressure level (decibel)
g	–	gram
g/kg	–	gram per kilogram
h	–	hour
ha	–	hectare
kg	–	kilogram
Kg/d	–	kilogram per day
kg/m^3	–	kilogram per cubic meter
km	–	kilometer
km/h	–	kilometer per hour
kV	–	kilo–volt
kV/m	–	kilo–volt per meter
kw	–	kilo-watt
L	–	liter
L/d	–	liter per day
m	–	meter
m^2	–	square meter
m^3	–	cubic meter
m/s	–	meter per second
mg	–	milligram
mg/L	–	milligram per liter
mg/m^3	–	milligram per cubic meter
mm	–	millimeter
mm/y	–	millimeter per year
mT	–	milli–Tesla
no./L	–	number of individuals per liter
t	–	metric ton
t/a	–	metric ton per annum
t/d	–	metric ton per day
µ	–	micron or micrometer
µg	–	microgram
$µg/m^3$	–	microgram per cubic meter
µT	–	micro–Tesla
V/m	–	volt per meter

NOTE

In this report, "$" refers to US dollars.

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I. EXECUTIVE SUMMARY

A. Background

1. This initial environmental examination (IEE) report was prepared for the proposed construction of the Xichang West Railway Station on the E'mei–Miyi section of the Chengkun Rail Line located in Sichuan Province in the People's Republic of China (PRC). The proposed project has been classified by the Asian Development Bank (ADB) as environment category B. This report was prepared based on available information in the environmental impact report (EIR), the revised EIR and the feasibility study report (FSR) for capacity enhancement of the E'mei–Miyi section of the Chengkun Rail Line. All these reports have been approved by the relevant authorities. Site reconnaissance at the station location was also conducted by the project preparation technical assistance (PPTA) consultant.

2. The Chengkun Rail Line connects Chengdu in Sichuan Province with Kunming in Yunnan Province, and is a key part of a regional corridor that will eventually extend to the countries in the Greater Mekong Subregion (GMS) to western PRC and the Eurasian land bridge. The existing line between Chengdu and Kunming was built between 1958 and 1970. It is a single track line with operating speed ranging from 40 km/h to 60 km/h. It has been operating at nearly full capacity for more than 10 years. The China Railway Corporation (CRC) is expanding the capacity of this railway line, involving construction of 860 km (645 km in Sichuan and 215 km in Yunnan) of double track electrified main railway line for passenger and freight transport. The proposed alignment of the new Chengkun Rail Line will be shortened by 236 km (21.5%) compared to the existing single track line (1,096 km) and has better geometry. Train speed on the new line would be increased to 160 km/h. The tonnage could increase from 3,200 t to 4,000 t net per train. The capacity of train–pairs per day would increase from 43 to 180. The shorter alignment and faster train speed would decrease the travel time from Chengdu to Kunming to less than 8 hours for passenger trains compared to the present 18–22 hours.

3. The E'mei–Miyi Line is the middle section of the Chengkun Rail Line. The existing E'mei–Miyi section has a total length of 535 km, with 61 stations and approximately 12 passenger trains and 23 cargo trains each way per day. The proposed capacity enhancement of the E'mei–Miyi section totals 392 km (consisting of 386 km main line and 6 km branch line) and includes the re-construction of 2 existing stations and construction of 16 new stations, with 149 bridges and 53 tunnels. Capacity enhancement of the main line consists of construction of a second track totaling 5.5 km from E'mei to Yangang (total two tracks) and construction of two new tracks totaling 378 km from Yangang to Miyi (total three tracks). The operational intent is to use the existing track for a few slow passenger trains and freight trains, and the new tracks for fast passenger and freight trains.

B. Project Design

4. The **impact** of the project is development of sustainable railway system in southwestern PRC. The **outcome** of the project is development of integrated, energy efficient and sustainable railway corridor in Sichuan province. The project will deliver three **outputs**.

5. **Output 1: Multimodal Hub developed.** This project will construct a multimodal passenger hub in Xichang (Xichang West Station) which is a growing tourist destination in Sichuan province. Xichang City is the capital of Liangshan Prefecture in Sichuan Province, located in the middle of the Chengdu-Kunming railway line (CKRL). The hub will include good intermodal connectivity and energy efficiency features in the form of improved insulation and

enhanced air ventilation systems and conform to PRC's standard for green buildings. It will have provision for renewable energy generation through solar PV. The hub will incorporate a bus station for long distance, local and tourist buses; ticketing and support facilities; parking for cars, motorcycles, bicycles and pedestrian walkways linking the railway station to the other transport modes to facilitate intermodal transfers.

6. **Output 2: Railway maintenance improved.** Track renewal and track laying operations require high expenditure for personnel and machines. With the help of mechanized work methods these costs can be significantly reduced and a higher quality can be achieved. This output will procure modern railway track maintenance machines. The equipment will cover track inspection and repair as well as rescue and restoration equipment.

7. This output will also include capacity building for railway maintenance measures and training on railway maintenance systems. Working with the executing agency (EA), the design institutes, and the railway administrations, the existing institutional arrangements for railway maintenance will be reviewed, and recommendations made to make these more mechanized, efficient and reliable. Staff from pertinent government agencies will receive training on maintenance systems to better equip them to improve the quality of maintenance. About 100 staff from executing and implementing agencies will be trained, and technical exchanges on maintenance technologies and new maintenance techniques will be organized to familiarize staff in these areas. Training on the operations of the new railway maintenance machines will be included in the procurement contracts. ADB will also provide railway asset management training through its Knowledge and Support Technical Assistance on Sustainable Transport.

8. Figure 1 shows the Chengkun Rail Line within which the E'mei–Miyi section and location of the new Xichang West Station. Since output 2 would not have potential environmental implications, this IEE only addresses output 1 and its potential environmental impacts during construction and operation.

9. **Land Take**. Project design of the Xichang West Station would result in a permanent land take of approximately 40.09 ha. About 99.5% of the permanent land take area is cultivated land with the remaining 0.5% being village houses for residential use. Land acquisition would result in the resettlement of 33 households with 132 residents, and demolition of approximately 11,453 m2 of buildings. Temporary land take would total approximately 32.75 ha for the borrow area and the spoil disposal site which are vacant areas with sparse vegetation. None of these sites is located near water bodies, drinking water protection zones, and ecologically sensitive habitats. These sites will be rehabilitated upon completion of construction.

C. Project Benefits

10. The proposed project is an integral part of the enhancement of the E'mei–Miyi section of the Chengkun Rail Line which is important in driving regional and local sustainable economic development and integration by connecting Sichuan Province and northwestern region with Yunnan province and GMS in Southeast Asia.

11. The E'mei–Miyi section traverses through some of the poorest areas in Sichuan Province, with populations dominated by ethnic minority groups. Capacity enhancement of the E'mei–Miyi section would reduce travel time from Chengdu to Kunming from the present 18–22 hours to less than 8 hours, and travel cost would be reduced by about 20%. This would facilitate better, cheaper and more efficient transport of passengers and freight, reducing the time and cost in getting the

agricultural products from the ethnic minority groups to the markets. Capacity enhancement of the E'mei–Miyi section would therefore result in improving the livelihood and economic conditions of these ethnic minority groups, thereby contributing to poverty alleviation.

12. Construction for the capacity enhancement of the E'mei–Miyi section would directly provide employment opportunities to over 242,000 person-years of unskilled labor from 2016 to 2022. Station operation would employ approximately 1,597 people. Construction of the Xichang West Station would provide employment opportunities for 100 workers throughout the 2-year construction period. Approximately 356 people would be employed to operate the Xichang West Station.

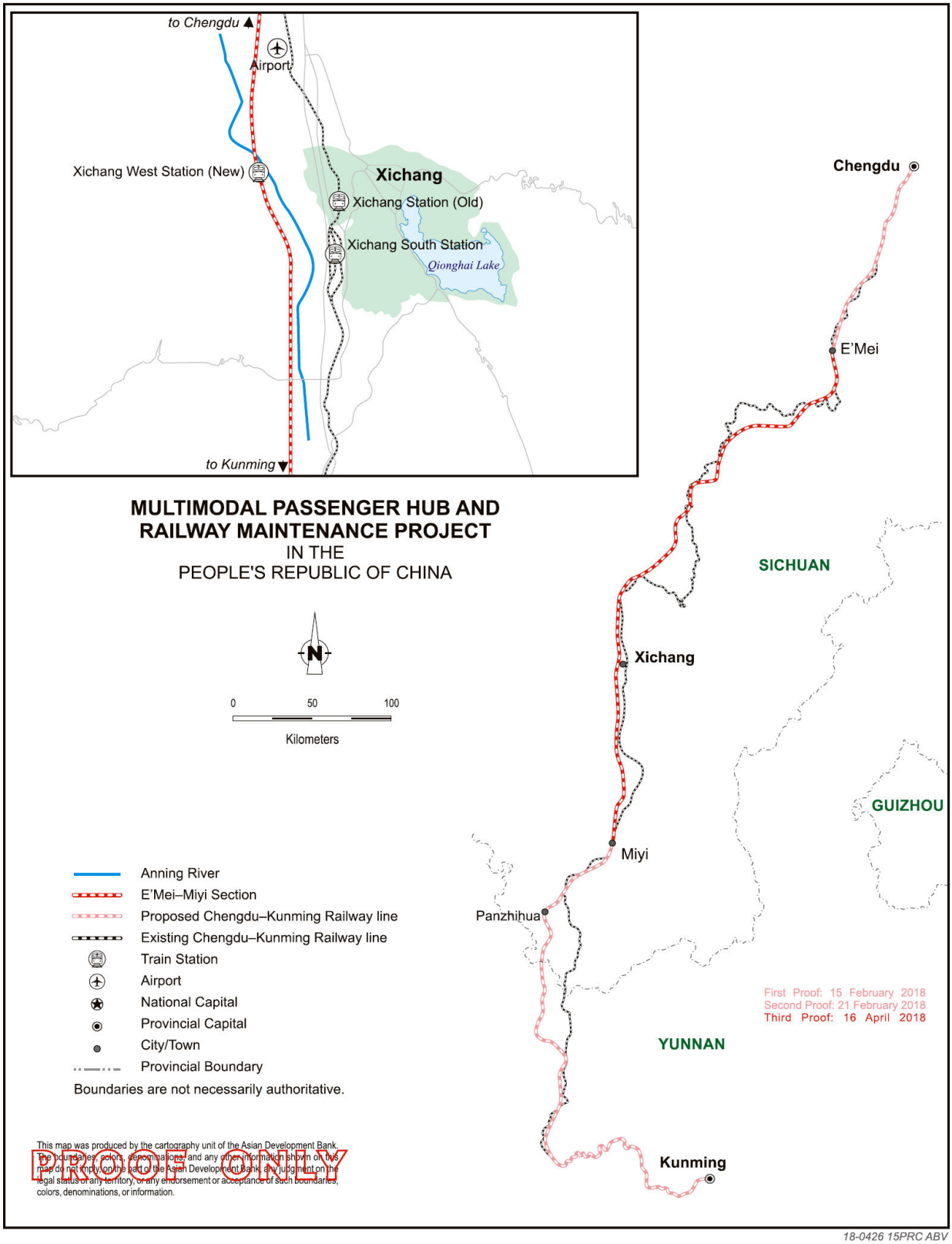

Figure 1: The Chengkun Railway Line showing the E'mei–Miyi section and the location of the Xichang West Station

13. The number of train passengers per year is expected to reach 1 billion in 2025 and 1.3 billion in 2035. The number of passengers per year at the 18 stations has been estimated to reach 5.88 million in 2025 and 7.54 million in 2035. The annual passenger throughput at the Xichang West Station has been predicted to reach 5.99 million in 2030 and 8.12 million in 2040. Cargo throughput at the stations (inbound plus outbound) has been estimated to be over 65 million t in 2025 and 83 million t in 2035, compared to 28.6 million t in 2012. Increase in the number of passengers and freight tonnage using rail equates to a decrease of passengers and freight using road transport, which would contribute to reductions in air and greenhouse gas emissions from motor vehicles.

D. Project Impacts and Mitigation Measures

14. **Air Quality and Noise**. There are scattered households near the station site. Dust from construction site was estimated to affect up to a distance of 150 m downwind if no mitigation is applied. Dust suppression measures would be implemented to protect the sensitive receptors within 150 m of the construction site. Construction noise is controlled at the boundary of the construction site in the PRC, and noise mitigation measures would be adopted to contain the construction noise within the construction site. These mitigation measures have been specified in the EMP and would also be included in the civil works tender documents and contracts. With the implementation of these measures, dust and noise generated during station construction would be mitigated to acceptable levels.

15. Since the trains will be powered by electricity, there would be no local air quality impact from trains per se during operation. It is estimated that 2.85 million people would use Xichang train station annually once it is fully operational. Possible transport modes of those users travelling between Xichang station and city center/its vicinities would be public buses, taxis, and/or private cars. According to the Xichang government's plan, public buses connecting Xichang station would be electric buses. Thus, no local air quality impact from bus users is not expected. Indirect and induced local air quality impact would be from train users using taxis and/or private car users travelling to Xichang station. Considering green house gases emissions of those indirect and induced travel to Xichang station (the Project), it is estimated that around 5,500 tons per year of carbon dioxide would be induced. This estimation would be further verified during the project implementation.

16. Operational noise at the station would cause exceedance of noise standards at sensitive receptors within 200 m of the station that have a direct line of sight to the station. Mitigation measures would include the construction of noise barriers (at source along the railway line) and the provision of double-glazed windows for affected households (at the receptor). Vibration has been found to be a non-issue for station operation.

17. **Water Quality**. Wastewater generated from construction activities such as concrete batching plants would be treated with sedimentation tanks and the supernatant would be reused on site for dust suppression. Wastewater generated from construction workers would be treated with septic tanks or portable toilets on site to meet relevant effluent standards prior to discharge into nearby drainage ditches.

18. During station operation, approximately 205 m^3/d of wastewater would be generated. Wastewater treatment would be by sequential batch reactor. Treated wastewater in compliance with the applicable effluent standard would be discharged to nearby drainage ditch leading to the Anning River approximately 1.5 km away.

19. **Biological Resources and Ecology**. The station site, comprising mainly of cultivated land, occupy approximately 0.35% of the cultivated land within the ecological assessment area for the capacity enhancement of the E'mei–Miyi section. Temporary land take for borrow area and spoil disposal site is predominantly vacant land, and takes up approximately 0.15% of the ecological assessment area. The revised EIR indicates the absence of protected species, old trees, critical and natural habitats within the station site and temporary land take areas. The revised EIR concluded that based on the scale of impact on vegetation in relation to the scale within the ecological assessment area, such impact would not drastically alter the germplasm resource, the floral composition and the agricultural production structure within the ecological assessment area. Potential construction or operational impact on biological resources and ecology should be minimal.

20. **Solid Waste**. Construction and demolition waste would consist of about 11,164 t of building demolition waste and 0.9 million m^3 of earth cut spoil. The former would be transported to locations designated by the local authorities for storage and treatment. The latter would be disposed of at the spoil disposal site. Earth cut and fill balance indicates that 0.1% of the earth cut spoil would be re-used for the station back fill material.

21. Small quantities of refuse (approximately 25 kg/d) would also be produced by construction workers daily and these would be regularly collected by local sanitation bureaus for disposal at local sanitary landfills.

22. Operation of the Xichang West Station would generate approximately 0.53 t/d of refuse. This will be regularly collected by the local sanitation bureau for disposal at local sanitary landfill.

23. **Soil Erosion**. It was estimated that soil erosion from the construction sites for the 18 stations would total approximately 418,000 t, including approximately 54,000 t erosion from background loss. There was no breakdown on soil erosion data for individual stations. Soil erosion prevention would include the implementation of engineering measures, planting measures and temporary measures during station construction. Implementation of these measures would reduce soil erosion due to the project by about 97.8%.

24. **Physical Cultural Resources**. The revised EIR has reviewed and confirmed that no physical cultural resource as defined in SPS (2009) has been found to occur within the footprint of the stations site. Should buried artifacts of archaeological importance be uncovered during the construction stage within the project area, construction will be stopped and the discovery will be immediately reported to the local cultural bureau in accordance with the PRC's *Cultural Relics Protection Law* (2002) and the *Cultural Relics Protection Law Implementation Ordinance* (2003).

25. **Electromagnetic Radiation**. The traction substation to be constructed could potentially emit electromagnetic radiation. The revised EIR estimated that the magnetic induction strength and the electric field strength at the boundary wall of the substations would comply with relevant standards.

26. **Associated Facilities**. The proposed project of constructing the Xichang West Station is an integral part of the capacity enhancement of the E'mei-Miyi section. The Chengkun Rail Line within which the E'mei–Miyi section is considered as the associated facility of the project in accordance with the ADB SPS (2009). The environmental due diligence was already carried out under L-3556: PRC Mountain Railway Safety Enhancement Project, which was approved on August 2017. The findings revealed that all the required domestic reports had been approved by the relevant authorities. Project design of the associated facility had adopted the avoidance principle on sensitive habitats, including revising the alignment to increase the distances between

the rail alignment and sensitive habitats, protected areas and cultural heritage site; and using tunnels and bridges to cross protected areas such as Giant Panda habitats, scenic areas and nature reserve. The revised EIR had included an environmental management plan (EMP), requiring the implementation of mitigation measures, environmental supervision and environmental monitoring during construction. It was concluded that potential environmental impacts caused by the associated facility would be acceptable if the EMP were diligently implemented.

E. Information Disclosure, Consultation and Participation

27. Information disclosure and public consultation, which included questionnaire surveys and discussion forums, were conducted for the capacity enhancement of the E'mei–Miyi section. Information was disclosed on the Sichuan Daily News twice and on the local government websites. The latter included a summary of the revised EIR. No adverse comment was received.

28. Questionnaire survey included 176 participants from organizations and 1,433 individuals from affected communities. The majority viewed the capacity enhancement of the E'mei–Miyi section to be significant in promoting economic development, speeding up the development of tourism, and improving traffic conditions and travel convenience. Major environmental impacts were deemed to be land take and noise and vibration during construction, and noise and vibration during operation. Most of the participants indicated their understanding on potential impacts and most emphasized the need to implement mitigation measures.

29. A questionnaire survey and a discussion forum were conducted in Xichang City in June 2014 pertaining to the Xichang West Station section of the railway line. Both resulted in total support from the participants. The participants deemed key project benefits to be economic development, tourism development, trip convenience and improving traffic conditions. The participants also deemed noise and vibration and electromagnetic interference to be key environmental impacts of the project and the need to adopt mitigation measures.

F. Grievance Redress Mechanism

30. This report and the EMP describe a project grievance redress mechanism (GRM) to document and resolve complaints from affected people. The GRM will be coordinated by the project management office (PMO), which will set up a complaint center with a hotline for receiving environmental and resettlement grievances which will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple points of entry and modes of access, including face-to-face meetings, written complaints, telephone conversations, or e-mail will be available.

G. Key EMP Implementation Responsibilities

31. The China Railway Corporation (CRC) is the executing agency (EA) and the ChengKun Railway Company Limited (CKRC) will be the implementing agency (IA). The IA has established the PMO, who on behalf of the EA/IA shall be responsible for the day-to-day management of the project. PMO will have overall responsibility for supervision of the implementation of environmental mitigation measures, coordinating the project level GRM, and reporting to ADB. PMO will appoint an environment coordinator on its staff to supervise the effective implementation of the EMP and to coordinate the project level GRM. To ensure that the contractors comply with the EMP provisions, the PMO will ensure that the environmental contract clauses listed in the EMP will be incorporated into all civil works tender documents and contracts. PMO will prepare

annual environment monitoring reports (EMR) with assistance from the loan implementation environment consultant (LIEC) under the PMC services and submit the EMRs to ADB. The IA will contract the local environmental monitoring stations (EMS) to implement environmental monitoring in accordance with the environmental monitoring program in the EMP.

H. Risks and Key Assurances

32. The main project risks include the inexperience of the EA, IA, PMO, and contractors on ADB SPS (2009), which may lead to ineffective implementation of EMP, EMoP, and GRM during construction and operational stages. These risks will be mitigated by (i) providing training in environmental management and monitoring; (ii) appointing qualified project management consultant (PMC) and qualified loan implementation environmental consultant (LIEC) with ADB project experience; and (iii) ADB conducting project implementation review missions.

33. Key assurances cover ADB environmental safeguard requirements during project implementation. The EMP also includes a list of environmental contract clauses for incorporation into all civil works tender documents and contracts, thus making the implementation of environmental mitigation measures during construction legally binding for the contractors.

I. Overall Conclusion

34. This IEE shows that potential environmental impacts can be reduced to acceptable levels with appropriate mitigation. The EMP has specified mitigation measures to be implemented and responsible parties, and how the impacts are to be monitored during construction and operation. While the railway services between Chengdu and Kunming will reduce travel time and cost for freight and passengers, the project will improve multi-modal transport connection and facilitate user-friendly access at Xichang station of the Chengdu-Kunming line. The project will contribute to improving the quality of life along the E'mei–Miyi section, facilitating socio-economic development, and reducing poverty. The increase of passenger numbers using the rail line would reduce the number of passengers using road transport, thereby reducing carbon emissions from road traffic. Developing the Xichang West Station into an efficient multimodal passenger hub will have demonstration effect on other railway station developments in the PRC.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. Policy Framework

35. Capacity enhancement of the E'mei–Miyi section is in line with the "transformation and expansion of existing railway" under Type 1 Encouragement Category of the *Guidance list for industrial structure adjustment* (2011 version)(amendment) under National Development and Reform Commission (NDRC) decree [2011] number 21[1]. It is also in accordance with the *Medium and long term development plan for integrated traffic network* (NDRC [2007] No. 3045)[2], *Medium and long term railway network plan (2008 Adjustment)*[3], *12th five year plan for integrated traffic and transport system planning* (State Council [2012] No. 18)[4], and *12th five year plan for railway*

[1] 《产业结构调整指导目录（2011 年本）（修正）》（国家发展改革委令【2011】第 21 号）
[2] 《综合交通网中长期发展规划》（发改交运【2007】3045 号）
[3] 《中长期铁路网规划（2008 年调整）》
[4] 《"十二五"综合交通运输体系规划》（国发【2012】18 号）

development planning (National Railway Bureau [2011] No. 80)[5]. The project proposal for upgrading the E'mei–Miyi section was approved by the NDRC in 2013 (NDRC [2013] No. 1693).

36. This project is aligned with the strategic priorities of the *Country partnership strategy 2016-2020* for the PRC in supporting inclusive economic growth as the project is in a lesser developed region, i.e. Sichuan Province in southwestern PRC[6].

B. Legal and Administrative Framework

37. The administrative framework for EIAs in the PRC consists of national, provincial, and local (city and county) environmental protection authorities. The national authority is the Ministry of Ecology and Environment (MEE)[7], formerly known as the Ministry of Environmental Protection (MEP), which promulgates laws, regulations, administrative decrees, technical guidelines, and environmental quality and emission standards on EIA and pollution prevention and control. At the provincial level are the Environmental Protection Departments (EPD), acting as the gatekeepers for EIA and pollution prevention and control in the provinces. They are often delegated the authority by MEE to approve EIA reports for development planning and construction projects in the provinces, except those with national interest and those that cross provincial boundaries that would need MEE approval. The local (city or county level) Environmental Protection Bureaus (EPB) enforce environmental laws and conduct environmental monitoring within city or county limits. Local EPBs could be delegated the authority to approve EIA reports by the provincial EPDs.

38. EPD and EPBs are supported by Environmental Monitoring Stations (EMS), which are the qualified entities to carry out environmental monitoring[8]. PRC has a qualification and registration system for EIA and only qualified and registered individuals are allowed to conduct EIA. Under the recently issued *Management Measures for the Qualification of Environmental Impact Assessment for Construction Projects* (MEP decree [2015] No. 36), institutes for conducting EIAs for construction projects in PRC can no longer be a subsidiary of an environmental authority responsible for approving domestic environmental impact reports or tables as of 1 November 2015.

C. Laws, Regulations, Guidelines, and Standards

39. **PRC Requirements.** Table 1 lists PRC's environmental laws, regulations, decrees, guidelines, and standards relevant to this project. These requirements cover environmental protection and impact assessment; pollution prevention and control on air, noise, water, ecology and solid waste; and are supported by technical guidelines and standards for assessing atmospheric, noise, water, and ecological impacts as well as controlling pollutant emissions and discharges.

Table 1: Relevant PRC laws, regulations, decrees, guidelines, and standards

Laws	
1	*Cultural Relics Protection Law of the PRC*, 1982 (amended in 2015) 《中华人民共和国文物保护法》2015 修订

[5] 铁路"十二五"发展规划》（铁计【2011】80 号）

[6] ADB. 2016. Transforming partnership: People's Republic of China and Asian Development Bank, 2016–2020. Manila

[7] In March 2018, the 13th People's Congress passed the resolution to restructure the Ministry of Environmental Protection (MEP) and renamed it the Ministry of Ecology and Environment (MEE).

[8] In this report, "environmental monitoring" refers to the activity of collecting environmental data either through *in-situ* measurements or through sampling followed by laboratory testing of samples.

2	*Water Pollution Prevention and Control Law of the PRC*, 1984 (amended in 2008)《中华人民共和国水污染防治法》2008 修订
3	*Wild Animal Protection Law of the PRC*, 1988 (second amendment 2016) 《中華人民共和國野生動物保護法》2016 年第二次修订
4	*Environmental Protection Law of the PRC*, 1989 (amended in 2014) 《中华人民共和国环境保护法》2014 修订
5	*Railway Law of the PRC, 1990* 《中华人民共和国铁路法》1990
6	*Soil and Water Conservation Law of the PRC*, 1991 (amended in 2010) 《中华人民共和国水土保持法》2010 修订
7	*Labor Law of the PRC*, 1994 《中华人民共和国劳动法》1994
8	*Solid Waste Pollution Prevention and Control Law of the PRC*, 1995 (amended in 2004) 《中华人民共和国固体废物污染防治法》2004 修订
9	*Environmental Noise Pollution Prevention and Control Law of the PRC*, 1996 《中华人民共和国环境噪声污染防治法》1996
10	*Atmospheric Pollution Prevention and Control Law of the PRC*, 2000 (amended in 2015) 《中华人民共和国大气污染防治法》2015 修订
11	*Occupational Disease Prevention and Control Law of the PRC*, 2001 《中华人民共和国职业病防治法》2001
12	*Water Law of the PRC*, 2002《中华人民共和国水法》2002
13	*Environmental Impact Assessment Law of the PRC*, 2002 (amended in 2016) 《中华人民共和国环境影响评价法》2016 修订
Regulations	
14	*Soil and Water Conservation Law Implementation Ordinance of the PRC,* 1993 (amended in 2011) 《中华人民共和国水土保持法实施条例》2011 修订
15	*Natural Reserve Ordinance of the PRC*, 1994 《中华人民共和国自然保护区条例》1994
16	*Wild Plant Protection Ordinance of the PRC,* 1996 《中华人民共和国野生植物保护条例》1996
17	*Construction Project Environmental Protection Management Ordinance of the PRC*, 1998 (amended 2017) 《中华人民共和国建设项目环境保护管理条例》2017 修订
18	*Basic Farmland Protection Ordinance of the PRC,* 1998 《中华人民共和国基本农田保护条例》1998
19	*Hazardous Chemicals Safe Management Ordinance of the PRC*, 2002 (amended in 2011) 《中华人民共和国危险化学品安全管理条例》2011 修订
20	*Cultural Relics Protection Law Implementation Ordinance of the PRC*, 2003 (amended in 2016) 《中华人民共和国文物保护法实施条例》2016 修订
21	*Scenic Area Ordinance of the PRC,* 2006 《中华人民共和国风景名胜区条例》2006
22	*Plan Environmental Impact Assessment Ordinance of the PRC*, 2009 《中华人民共和国规划环境影响评价条例》2009
23	*Railway Safety Management Ordinance of the PRC*, 2013 《中华人民共和国铁路安全管理条例》2013
Decrees and Announcements	
24	*Circular on strengthening the management of environmental impact assessment for construction projects financed by international financial organizations*, (MEE Announcement [1993] No.324) 《关于加强由国际金融机构提供资金的建设项目的环境影响评估管理的通知》环发[1993]324 号
25	*Circular on certain ideas in strengthening environmental supervision* (MEE Announcement [1999] No. 141) 《关于进一步加强环境监理工作若干意见的通知》 环发 [1999] 141 号
26	*Management measures for inspection and acceptance of environmental protection at construction project completion* (MEE Decree [2001] No. 13 and 2010 Amendment) 《建设项目竣工环境保护验收管理办法》环令 [2001] 13 号；2010 修改
27	*Circular on environmental noise issues related to the environmental impact assessment of highway and railway (including light rail) construction projects* (MEE Announcement [2003] No. 94) 《关于公路、铁路（含轻轨）等建设项目环境影响评价中环境噪声有关问题的通知》 环发 [2003] 94 号
28	*Environmental protection management measures for transportation construction projects* (Ministry of Transport [2003] No. 5) 《交通建设项目环境保护管理办法》交通部令 [2003]5 号
29	*Circular on launch of environmental supervision for transport project* (Ministry of Transport and MEE Announcement [2004] No. 314) 《关于开展交通工程环境监理工作的通知》交环发[2004] 314 号
30	*Specifications on the management of urban construction and demolition waste* (Ministry of Construction Decree [2005] No. 139) 《城市建筑垃圾管理规定》建设部令 [2005] 139 号
31	*Circular on management procedures required for the supervision, inspection and environmental acceptance of construction projects under the "Three Simultaneities"* (on trial) (MEE Announcement [2009] No. 150) 《环境保护部建设项目"三同时"监督检查和竣工环保验收管理规程（试行）的通知》环发 [2009]150 号
32	*Technical policy on the prevention and control of at grade traffic noise pollution* (MEE Announcement [2010] No. 7) 《地面交通噪声污染防治技术政策》环发 [2010]7 号
33	*Management measures for the operation of environmental complaint hotline* (MEE Decree [2010] No. 15) 《环保举报热线工作管理办法》环令 [2010] 15 号

34	*Opinion from the State Council on important tasks for strengthening environmental protection* (State Council Announcement [2011] No. 35 《国务院关于加强环境保护重点工作的意见》国发 [2011] 35 号
35	*Measures for environmental supervision* (MEE Decree [2012] No. 21) 《环境监察办法》环境保护部令 [2012] 21 号
36	*Requirement for the preparation of environmental impact report summary* (MEE Announcement [2012] No. 51)《建设项目环境影响报告书简本编制要求》环告 [2012] 51 号
37	*Circular on stepping up the strengthening of environmental impact assessment management for the prevention of environmental risk* (MEE Announcement [2012] No. 77《关于进一步加强环境影响评价管理防范环境风险的通知》环发 [2012] 77 号
38	*Atmospheric pollution prevention and control action plan* (State Council Announcement [2013] No. 37) 《大气污染防治行动计划》国发〔2013〕37 号
39	*Policy on integrated techniques for air pollution prevention and control of small particulates* (MEE Announcement [2013] No. 59) 《环境空气细颗粒物污染综合防治技术政策》环发[2013]59 号
40	*Guideline on government information disclosure of construction project environmental impact assessment (on trial)* (MEE Announcement [2013] No. 103) 《建设项目环境影响评价政府信息公开指南》环办 [2013] 103 号
41	*Measures for public participation in environmental protection* (MEE Decree [2015] No. 35) 《环境保护公众参与办法》环令 [2015] 35 号
42	*Management measures for environmental impact post assessment of construction projects* (on trial) (MEE decree [2015] No. 37) 《建设项目环境影响后评价管理办法（试行）》环令 [2015] 37 号
43	*Circular on the environmental impact assessment management of significant changes in construction projects for some industrial sectors* (MEE Announcement [2015] No. 52) 《关于印发环评管理中部分行业建设项目重大变动清单的通知》环办 [2015] 52 号
44	*Directory for the management of construction project environmental impact assessment categorization* (MEE Decree [2017] No. 44) 《建设项目环境影响评价分类管理名录》环令 [2017] 44 号
Guidelines	
45	HJ 2.1-2016 *Technical guidelines for environmental impact assessment of construction project – general programme*《建设项目环境影响评价技术导则 总纲》
46	HJ 2.2-2008 G*uidelines for environmental impact assessment – atmospheric environment*《环境影响评价技术导则 大气环境》
47	HJ/T 2.3-93 *Technical guidelines for environmental impact assessment – surface water environment*《环境影响评价技术导则 地面水环境》
48	HJ 2.4-2009 *Technical guidelines for noise impact assessment*《环境影响评价技术导则 声环境》
49	HJ/T 10.3-1996 *Guideline on management of radioactive environmental protection – environmental impact assessment standards and methods on electromagnetic radiation* 《辐射环境保护管理导则 – 电磁辐射环境影响评价方法和标准》
50	HJ 19-2011 *Technical guidelines for environmental impact assessment – ecological impact*《环境影响评价技术导则 生态影响》
51	HJ 24-2014 *Technical guidelines for environmental impact assessment of electric power transmission and distribution project* 《环境影响评价技术导则 输变电工程》
52	HJ 130-2014 *Technical guidelines for plan environmental impact assessment - general principles* 《规划环境影响评价技术导则 总纲》
53	HJ 192-2015 *Technical criterion for ecosystem status evaluation*《生态环境状况评价技术规范》
54	HJ/T 298-2007 *Technical specifications on identification for hazardous waste*《危险废物鉴别技术规范》
55	HJ/T 393-2007 *Technical specifications for urban fugitive dust pollution prevention and control* 《防治城市扬尘污染技术规范》
56	HJ 610-2016 *Technical guidelines for environmental impact assessment – groundwater environment*《环境影响评价技术导则 地下水环境》
57	HJ 616-2011 *Guidelines for technical review of environmental impact assessment on construction projects* 《建设项目环境影响技术评估导则》
58	HJ 623-2011 *Standard for the assessment of regional biodiversity*《区域生物多样性评价标准》
59	HJ 630-2011 *Technical guideline on environmental monitoring quality management*《环境监测质量管理技术导则》
60	HJ 663-2013 *Technical regulation for ambient air quality assessment* (on trial) 《环境空气质量评价技术规范（试行）》
61	HJ 664-2013 *Technical regulation for selection of ambient air quality monitoring stations* (on trial) 《环境空气质量监测点位布设技术规范（试行）》
62	HJ 710.1-2014 *Technical guidelines on biodiversity monitoring - terrestrial vascular plants*《生物多样性观测技术导则-陆生维管植物》
63	HJ 710.2-2014 *Technical guidelines on biodiversity monitoring - lichens and bryophytes*《生物多样性观测技术导则-地衣和苔藓》
64	HJ 710.3-2014 *Technical guidelines on biodiversity monitoring - terrestrial mammals* 《生物多样性观测技术导则-陆生哺乳动物》

65	HJ 710.4-2014 *Technical guidelines on biodiversity monitoring - birds*《生物多样性观测技术导则-鸟类》
66	HJ 710.5-2014 *Technical guidelines on biodiversity monitoring - reptiles*《生物多样性观测技术导则-爬行动物》
67	HJ 710.6-2014 *Technical guidelines on biodiversity monitoring - amphibians*《生物多样性观测技术导则-两栖动物》
68	HJ 710.7-2014 *Technical guidelines on biodiversity monitoring - inland water fish*《生物多样性观测技术导则-内陆水域鱼类》
69	HJ 710.8-2014 *Technical guidelines on biodiversity monitoring - freshwater benthic macroinvertebrates*《生物多样性观测技术导则-淡水底栖大型无脊椎动物》
70	HJ 710.9-2014 *Technical guidelines on biodiversity monitoring - butterflies*《生物多样性观测技术导则-蝴蝶》
71	HJ 2005-2010 *Technical specification of constructed wetlands for wastewater treatment engineering*《人工湿地污水处理工程技术规范》
72	HJ 2025-2012 *Technical specifications for collection, storage, transportation of hazardous waste*《危险废物收集、贮存、运输技术规范》
73	*Technical guidelines for environmental impact assessment - public participation (public comment version)*, (January 2011)《环境影响评价技术导则 公众参与》(征求意见稿)2011
Standards	
74	GB 3095-2012 *Ambient air quality standards*《环境空气质量标准》
75	GB 3096-2008 *Environmental quality standard for noise*《声环境质量标准》
76	GB 3838-2002 *Environmental quality standards for surface water*《地表水环境质量标准》
77	GB 8702-2014 *Controlling limits for electromagnetic environment*《电磁环境控制限值》
78	GB 8978-1996 *Integrated wastewater discharge standard*《污水综合排放标准》
79	GB 10070-88 *Standard of environmental vibration in urban area*《城市区域环境振动标准》
80	GB 12348-2008 *Emission standard for industrial enterprises noise at boundary*《工业企业厂界环境噪声排放标准》
81	GB 12523-2011 *Emission standard of environmental noise for boundary of construction site*《建筑施工场界环境噪声排放标准》
82	GB 12525-90 *Emission standards and measurement methods of railway noise on the boundary alongside railway line*《铁路边界噪声限值及其测量方法》
83	GB/T 14848-93 *Quality standard for ground water*《地下水质量标准》
84	GB/T 15190-2014 *Technical specifications for regionalizing environmental noise function*《声环境功能区划分技术规范》
85	GB 15618-1995 *Environmental Quality Standard for Soils*《土壤环境质量标准》
86	Soil environmental quality – risk control standard for soil contamination of development land (on trial)《土壤环境质量 – 建设用地土壤污染风险管控标准（试行）》
87	GB 16297-1996 *Air pollutant integrated emission standards*《大气污染物综合排放标准》
88	GB 18597-2001 *Standard for pollution control on hazardous waste storage*《危险废物贮存污染控制标准》
89	GB 50118-2010 *Design specifications for noise insulation of buildings for civil use*《民用建筑隔声设计规范》
90	GB 50433-2008 *Technical code on soil and water conservation of development and construction projects*《开发建设项目水土保持技术规范》
91	GB 50434-2008 *Control standards for soil and water loss on development and construction projects*《开发建设项目水土流失防治标准》
92	JGJ 146-2004 *Environmental and hygiene standards for construction sites*《建筑施工现场环境与卫生标准》

40. **Environmental Protection.** The most far-reaching law on pollution prevention and control is the *Environmental Protection Law of the PRC* (EPL) (1989, amended in 2014) (Table 1, item 4). When promulgated in 1989, it set out key principles for the nation's pollution control system, including the policy known as the "Three Simultaneities[9]", the application of pollution levy, and requirements for EIA. The EPL was amended in 2014 and the amended EPL took effect on 1 January 2015. The implementation of "Three Simultaneities" was further strengthened by the decrees on its management procedures (items 26 and 31) and the *Construction Project Environmental Protection Management Ordinance of the PRC* (1998) (item 17).

41. **Public participation and environmental information disclosure** provisions are among the most significant changes introduced in the amended EPL, further supported by the decrees

[9] The "Three Simultaneities Policy" requires the design, construction, and operation of pollution control and treatment facilities to occur simultaneously with the project design, construction, and operation.

on the preparation of EIA summaries for the purpose of public disclosure (item 36), information disclosure on construction project EIAs by government (item 40), methods for public participation in environmental protection (item 41), and technical guidelines (for comment) for public participation in EIAs (item 73).

42. The amended EPL further defines **enforcement and supervision** responsibilities of all levels of environmental protection authorities, imposes stricter obligations and more severe penalties on enterprises and construction units regarding pollution prevention and control, and allows for environmental public interest litigation including through nongovernment organizations. The procedures and requirements for the technical review of construction project EIA reports by authorities have been specified (item 57). Environmental supervision, inspection, and enforcement on design, installation, and operation of project-specific environmental protection and control measures are regulated under the "Three Simultaneities" (items 4, 17, 25, 29, and 31).

43. For **grievance redress**, a hotline number 12369 has been established at each level of environmental protection authority throughout the nation since March 2011 for receiving and resolving environmental complaints, in accordance with the *Management measures for the operation of environmental complaint hotline* (MEP Decree [2010] No. 15] (item 33).

44. The EPL also provides protection for **community health**, with protection of **occupational health and safety** provided by the *Labor Law of the PRC* (1994) (item 7), the *Occupational Disease Prevention and Control Law of the PRC* (2001) (item 11), the *Hazardous Chemicals Safe Management Ordinance of the PRC* (2002, amended in 2011) (item 19), and environmental and hygiene standards for construction sites (item 92).

45. **Environmental Impact Assessment.** EIAs are governed by the *Environmental Impact Assessment Law of the PRC* (2002, amended in 2016) (item 13), covering EIAs for (i) plans (such as new development areas and new industrial parks) and strategic studies which could also be deemed as strategic environmental assessments (SEAs), and (ii) construction projects. This was followed by the promulgation of two regulations: the *Construction Project Environmental Protection Management Ordinance of the PRC* (1998) (item 17) and the *Plan Environmental Impact Assessment Ordinance of the PRC* (2009) (item 22). Both require early screening and environmental categorization.

46. A recent decree, the *Directory for the management of construction project environmental impact assessment categorization* (MEP Decree [2017] No. 44) (item 44), classifies EIAs for construction projects into three categories with different reporting requirements, based on the "significance" of potential environmental impact due to the project and the environmental sensitivity of the project site as described in this directory. An environmental impact report (EIR) is required for construction projects with potentially significant environmental impacts. An environmental impact table (EIT) is required for construction projects with less significant environmental impacts. An environmental impact registration form (EIRF) is required for construction projects with the least significant environmental impacts. Items 158, 159 and 160 under Section 49 in the Decree specify the environmental impact reporting requirements for railway projects. It states that EIRs are required for (i) new railway lines except connecting or dedicated lines that are less than 30 km in length; (ii) electrification modification of $\geqslant$200 km, or railways involving environmentally sensitive areas, and (iii) large hubs[10]. All other railway projects would require EITs. Relevant environmentally sensitive areas for rail projects, as defined in the

[10] No threshold is given in the Decree on what constitutes a large hub.

Decree, include ecological protection areas, nature reserves; scenic areas; world cultural and natural heritage sites; drinking water source protection zones; basic farmland and grassland; forest parks; geological parks; important wetland; natural woodland; important nesting habitats for wild fauna; habitats for the growth and propagation of protected wild flora; important aquatic spawning, nursery, wintering and migration grounds; regions suffering from water resource shortage; serious soil erosion protection and preventions areas; desertification protection areas; enclosed or semi-enclosed water bodies; inhabited areas with major residential, health care, scientific research, and administration functions; and cultural heritage protection sites.

47. An EIR for the capacity enhancement of the E'mei–Miyi section of the Chengkun Rail Line was prepared by the China Railway Eryuan Engineering Group Co. Ltd. (CREEGC) in July 2014. It covered the construction and operation of 18 railway stations, including the Xichang West Station. The EIR was approved by MEP on 16 September 2014.

48. On 4 June 2015 MEP issued the *Circular on the environmental impact assessment management of significant changes in construction projects for some industrial sectors* (MEP Announcement [2015] No. 52) (item 43 in Table 1). The Circular provides attachments defining thresholds for significant changes in nine industrial sectors. Railway construction is one of the nine sectors. Any project that has changes triggering any of the thresholds is deemed to constitute significant changes, and a revised EIR shall be submitted to the relevant environmental authority for approval. Optimization of the E'mei–Miyi alignment during preliminary design resulted in a shifting of approximately 39% of the alignment, which triggered the threshold for significant change for railway projects. In compliance with the Circular, a revised EIR was prepared by CREEGC in October 2015. The revised EIR was approved by MEP on 28 October 2015. This IEE is prepared based on information related to the Xichang West Station provided in the original EIR, the revised EIR and the feasibility study report (FSR) for the E'mei–Miyi section of the Chengkun Rail Line.

49. **Follow-Up Actions on Environmental Impact Assessment.** In 2015, MEP issued a decree, *Management measures for environmental impact post assessment of construction projects* (MEE decree [2015] No. 37) (item 42) to have, on a trial basis and effective 1 January 2016, follow-up actions between 3 to 5 years after commencement of project operation. Such actions would include environmental monitoring and impact assessment to verify the effectiveness of environmental protection measures and to undertake any corrective actions that might be needed. The decree also specifies that the institute that does the original impact assessment for the project cannot undertake environmental impact post assessment for the same project.

50. **Guidelines and Standards.** MEE has issued a series of technical guidelines for preparing EIAs. These include impact assessment guidelines on general EIA program and principles (items 45 and 52), atmospheric environment (item 46) and ambient air quality (item 60), noise (item 48), surface water (item 47), ground water (item 56), electromagnetic radiation (item 49), ecology (items 50 and 53) and regional biodiversity (item 58), biodiversity monitoring of various biota (items 62 to 70), quality management on environmental monitoring (item 59), and public participation (item 73). Standards issued by MEE generally consist of environmental quality (ambient) standards (applicable to the receiving end) and emission standards (applicable to the pollution source). The former includes standards for ambient air quality (item 74), noise (item 75) and vibration (item 79), surface water (item 76), groundwater (item 83), soil (items 85 and 86), and electromagnetic environment (item 77) etc. The latter includes standards for integrated wastewater discharge (item 78), construction noise (item 81) and railway operational noise (item

82), air pollutants (87), soil erosion (item 91) and construction site environment and hygiene (item 92), etc.

51. **Legal Requirements Specific to Railway Projects.** Regulations and decrees listed in Table 1 that are specific to railway projects include the *Railway Law of the PRC* (1990) (item 5), item 23 on railway safety management, item 27 on rail noise problems during impact assessment, item 28 on environmental protection management measures, and item 29 on environmental supervision for transport projects.

52. **ADB Environmental Safeguard Requirements.** The proposed project involving the construction and operation of the Xichang West Station is classified as category B for environment by ADB as it is considered unlikely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. This project therefore requires the preparation of an IEE report which includes an EMP. Where appropriate this IEE includes a number of ADB's SPS 2009 considerations. These include, among others, (i) project risks and respective mitigation measures and project assurances; (ii) project-level GRM; (iii) definition of the project area of influence; (iv) consideration of physical cultural resources; (v) climate change mitigation and adaptation; (vi) occupational and community health and safety requirements; (vii) economic displacement that is not part of land acquisition; (viii) consideration of biodiversity conservation and natural resources management requirements; (ix) provision of justification if local environmental quality standards are used; (x) meaningful consultation and participation; and (xi) implementation schedule and (measurable) performance indicators in the EMP.

53. **Relevant International Agreements.** PRC is a signatory to a number of international agreements relevant to environment protection. Those relevant to the project, along with the dates of signing by the PRC, are listed in Table 2.

Table 2: International agreements with the PRC as a signatory

No.	Name of Agreement	PRC Signing Date	Agreement Objective
1	*Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat*	1975.12.21	To stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the wetlands' ecological functions and their economic, cultural, scientific, and recreational values
2	*Montreal Protocol on Substances That Deplete the Ozone Layer*	1989.01.01	To protect the ozone layer by controlling emissions of substances that deplete it
3	*Convention on Biological Diversity*	1993.12.29	To develop national strategies for the conservation and sustainable use of biological diversity
4	*United Nations Framework Convention on Climate Change*	1994.03.21	To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system
5	*United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification*	1996.12.26	To combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements
6	*Kyoto Protocol to the United Nations Framework Convention on Climate Change*	2005.02.23	To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries

D. Evaluation Standards

54. In PRC, ambient conditions of air, noise, and water quality in the project area determine the appropriate category of emissions and effluent standards for the construction and operational phases of built infrastructure. However, the World Bank Group (WBG) Environmental, Health and Safety (EHS) guidelines[11] (see below) are based on international best practice construction and operational procedures. Both the PRC standards and EHS guidelines are used in the assessments and the PRC standards are used for compliance checking of potential impacts from this project.

55. **Air Quality.** PRC ranks air quality into two classes according to its *Ambient air quality standard* (GB 3095-2012). Class I standard applies to nature reserves, scenic areas, and regions requiring special protection. Class II standard applies to residential areas, mixed residential/commercial areas, cultural areas, industrial zones, and rural areas. The ambient air quality in the assessment area of this project has been assigned to meet GB 3095-2012 Class II standard. The WBG adopted the World Health Organization (WHO) standards for its EHS standards for air quality.

56. On 10 September 2013, the State Council issued the *Atmospheric pollution prevention and control action plan* for the PRC (State Council Announcement [2013] No. 37) (see Table 1, item 38). The action plan set 2017 targets on reducing PM_{10} emissions in prefecture level cities by more than 10%; $PM_{2.5}$ emissions by approximately 25%, 20% and 15% in Beijing-Tianjin-Hebei region, Yangtze River Delta, and Pearl River Delta respectively; and controlling annual average $PM_{2.5}$ levels in Beijing at around 60 μg/m^3. Among the 35 actions identified and described in the plan, the following are deemed to be relevant to this project:

(i) Strengthen control of aerial sources of pollution including controlling dust pollution during construction;
(ii) Strictly implement total emission pollution control on SO_2, NO_x, dust, and volatile organics as a pre-requisite in approving construction project EIRs;
(iii) Optimize spatial pattern in urban and new district planning to facilitate better air pollutant dispersion;
(iv) Strengthen laws, regulations and standards on controlling air pollution;
(v) Strengthen capacities in environmental management and supervision system;
(vi) Increase environmental regulatory enforcement;
(vii) Implement environmental information disclosure;
(viii) Strictly enforce accountability;
(ix) Establish monitoring warning system;
(x) Develop contingency plan; and
(xi) Adopt timely contingency measures for public health protection during serious air pollution events.

57. WHO established air quality guideline (AQG) standards for various air quality parameters for the protection of public health. Yet WHO recognizes that progressive actions are needed to achieve these standards and the financial and technological limitations of some countries, cities or localities especially in developing countries, interim targets were also established as intermediate milestones towards achieving the AQG.

[11] World Bank Group. 2007. *Environmental, health and safety guidelines-General EHS guidelines*. Washington, DC

58. Table 3 compares PRC's GB 3095–2012 *Ambient air quality standards* and the World Bank Group's EHS standard which has adopted the WHO AQG. The longer averaging period such as annual average is more applicable to assessing impacts from multiple as well as regional sources; while shorter averaging periods such as 24 hours and 1 hour averages are more applicable to assessing short-term impacts from project-related activities such as daily or peak construction activities.

Table 3: Comparison of PRC and WBG ambient air quality standards

Air Quality Parameter	Averaging Period	PRC GB 3095-2012 (μg/m^3)		WHO/World Bank Group EHS[12] (μg/m^3)	
		Class I	Class II	Interim Targets	AQG
SO_2	1-year	20	60	n/a	n/a
	24-hour	50	150	50 - 125	20
	1-hour	150	500	n/a	n/a
TSP	1-year	80	200	n/a	n/a
	24-hour	120	300	n/a	n/a
PM_{10}	1-year	40	70	30 - 70	20
	24-hour	50	150	75 - 150	50
$PM_{2.5}$	1-year	15	35	15 - 35	10
	24-hr	35	75	37.5 - 75	25
NO_2	1-year	40	40	n/a	40
	24-hour	80	80	n/a	n/a
	1-hour	200	200	n/a	200
CO	24-hour	4,000	4,000	n/a	n/a
	1-hour	10,000	10,000	n/a	n/a
Note: n/a = not available					

59. The following observations are made comparing PRC and WBG ambient air quality standards as shown in Table 3, showing that WBG interim targets are comparable to PRC's GB 3095–2012 Class II standard:

(i) 24-hr SO_2: the upper limit of EHS interim target (125 μg/m^3) is 17% more stringent than GB Class II standard (150 μg/m^3), while the lower limit of EHS interim target (50 μg/m^3) is the same as the GB Class I standard;
(ii) 24-hour PM_{10}: the upper limit of the EHS interim target (125 μg/m^3) is the same as GB Class II standard, while the AQG is the same as the GB Class I standard
(iii) 24-hr $PM_{2.5}$: the upper limit of the EHS interim target (75 μg/m^3) is the same as GB Class II standard; and
(iv) 24-hour NO_2: the EHS AQG (200 μg/m^3) is the same as GB Class II standard.

60. Emission standards of fugitive particulate matter (such as dust) from construction sites and concrete batching plants are regulated under PRC's *Air pollutant integrated emission standard* (GB 16297–1996). For particulate matter, the maximum allowable emission concentration is 120 mg/m^3 and the concentration limit at the boundary of construction sites is $\leqslant$ 1.0 mg/m^3, with no specification on the particulate matter's particle diameter.

61. **Noise.** PRC's *Environmental quality standard for noise* (GB 3096–2008) categorizes five noise functional areas based on their tolerance to noise pollution: from category 0 to category 4. Category 0 is for areas with convalescent facilities that are the least tolerant to noisy environment

[12] World Bank Group. 2007.

and therefore has the most stringent day and night time noise standards. Category 1 is for areas predominated by residential areas, hospitals and clinics, educational institutions, and research centers. Category 2 is for areas with mixed residential and commercial functions. Category 3 is for areas with industrial production and storage and logistics functions. Category 4 is for regions adjacent to traffic noise sources such as major roads and railways, and is subdivided into 4a and 4b with the former applicable to major road (road class II and above) and marine traffic noise, and the latter applicable to rail noise. The *Technical specifications for regionalizing environmental noise function* (GB/T 15190–2014) defines the distances for 4a and 4b regions from the road/railway boundary to be (i) 50 m ± 5 m for Category 1 noise functional area; (ii) 35 m ± 5 m for Category 2 noise functional area; and (iii) 20 m ± 5 m for Category 3 noise functional area. Beyond the 4a or 4b region, the noise levels are based on the respective noise functional area categories.

62. Standards for various noise functional area categories are compared with the WBG's EHS guidelines in Table 4, showing that the EHS guidelines have lower noise limits for residential, commercial, and industrial mixed areas but higher noise limits for industrial areas. The EHS guidelines do not consider influencing factors such as major roads or railways and apply the same noise limits based on whether the areas are for residential or industrial use.

Table 4: Environmental quality standards for noise [equivalent sound level L_{Aeq}: dB(A)]

Noise Functional Area Category	Applicable Area	GB 3096-2008 Standards		WBG EHS[13] Standards	
		Day 06:00-22:00	Night 22:00-06:00	Day 07:00-22:00	Night 22:00-07:00
0	Areas needing extreme quiet, such as convalescence areas	50	40	55	45
1	Areas mainly for residence, hospitals, cultural and educational institutions, administration offices	55	45		
2	Residential, commercial and industrial mixed areas	60	50		
3	Industrial areas, warehouses and logistic parks	65	55	70	70
4a	Within the following distances from both sides of trunk road (class II and above): (i) 50 m ± 5 m for Category 1 functional area (ii) 35 m ± 5 m for Category 2 functional area (iii) 20 m ± 5 m for Category 3 functional area	70	55	55	45
4b	Within the following distances from both sides of railway: (i) 50 m ± 5 m for Category 1 functional area (ii) 35 m ± 5 m for Category 2 functional area (iii) 20 m ± 5 m for Category 3 functional area	70	60[14]		

63. The noise functional area surrounding the Xichang West Station has been assigned category 2 by the local EPB. Therefore the category 4b standard (applicable to rail noise) of 70 dB(A) day time and 60 dB(A) night time applies to noise sensitive receptors located within 40 m (35 m ± 5 m) from the center of the outermost railroad track, while the category 2 standard of 60 dB(A) day time and 50 dB(A) night time standard applies to noise sensitive receptors beyond 40 m from the center of the outermost railroad track.

64. The PRC's *Emission standard of environmental noise for boundary of construction site* (GB 12523–2011) regulates construction noise, limiting construction noise levels at the

[13] World Bank Group. 2007.

[14] Night time noise standard for railways constructed and operational or with EIA approval before 31 December 2010 is 70 dB(A) according to GB 12525-90 (amendment) *Noise Limit on Railway Boundary and Its Measurement Method*.

construction site boundary to 70 dB(A) in the day time (0600–2200 hours) and 55 dB(A) at night (2200–0600 hours). The WBG does not have standards for construction noise *per se*, but applies the same noise standards listed in Table 4 above to the receptors during construction activities.

65. **Surface Water Quality**. For water quality assessment, the determining standard is the PRC's *Environmental quality standards for surface water* (GB 3838–2002). It defines five water quality categories for different environmental functions. Category 1 is the best, suitable for head waters and national nature reserves. Category 2 is suitable for drinking water sources in Class I protection areas, habitats for rare aquatic organisms, breeding grounds for fish and crustaceans, and feeding grounds for fish fry. Category 3 is suitable for drinking water sources in Class II protection areas, wintering grounds for fish and crustaceans, migration routes, water bodies for aquaculture and capture fishery, and swimming activities. Category 4 is suitable for general industrial use and non-contact recreational activities. Category 5 is the worst which is only suitable for agricultural and scenic water uses. These standards are presented in Table 5. The WBG has guidelines on effluent quality standards but not ambient water quality, and recognizes the use of local ambient water quality criteria for EHS purpose.

Table 5: Environmental quality standards for surface water GB 3838–2002

Parameter	Water Quality Category				
	1	2	3	4	5
pH	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9	6 ~ 9
Dissolved oxygen (DO) [mg/L]	90% saturation or ⩾7.5	⩾6	⩾5	⩾3	⩾2
Permanganate index (I_{Mn}) [mg/L]	⩽2	⩽4	⩽6	⩽10	⩽15
Chemical oxygen demand (COD) [mg/L]	⩽15	⩽15	⩽20	⩽30	⩽40
5-day Biochemical oxygen demand (BOD_5) [mg/L]	⩽3	⩽3	⩽4	⩽6	⩽10
Ammonia nitrogen (NH_3-N) [mg/L]	⩽0.15	⩽0.5	⩽1.0	⩽1.5	⩽2.0
Total phosphorus (as P) [mg/L]	⩽0.02	⩽0.1	⩽0.2	⩽0.3	⩽0.4
Lakes & reservoirs	⩽0.01	⩽0.025	⩽0.05	⩽0.1	⩽0.2
Total nitrogen (lakes, reservoirs, as N) [mg/L]	⩽0.2	⩽0.5	⩽1.0	⩽1.5	⩽2.0
Copper (Cu) [mg/L]	⩽0.01	⩽1.0	⩽1.0	⩽1.0	⩽1.0
Zinc (Zn) [mg/L]	⩽0.05	⩽1.0	⩽1.0	⩽2.0	⩽2.0
Fluoride (as F^-) [mg/L]	⩽1.0	⩽1.0	⩽1.0	⩽1.5	⩽1.5
Selenium (Se) [mg/L]	⩽0.01	⩽0.01	⩽0.01	⩽0.02	⩽0.02
Arsenic (As) [mg/L]	⩽0.05	⩽0.05	⩽0.05	⩽0.1	⩽0.1
Mercury (Hg) [mg/L]	⩽0.0005	⩽0.0005	⩽0.0001	⩽0.001	⩽0.001
Cadmium (Cd) [mg/L]	⩽0.001	⩽0.005	⩽0.005	⩽0.005	⩽0.01
Chromium (Cr, hexavalent) [mg/L]	⩽0.01	⩽0.05	⩽0.05	⩽0.05	⩽0.1
Lead (Pb) [mg/L]	⩽0.01	⩽0.01	⩽0.05	⩽0.05	⩽0.1
Cyanide (CN) [mg/L]	⩽0.005	⩽0.05	⩽0.2	⩽0.2	⩽0.2
Volatile phenol [mg/L]	⩽0.002	⩽0.002	⩽0.005	⩽0.01	⩽0.1
Total petroleum hydrocarbon (TPH) [mg/L]	⩽0.05	⩽0.05	⩽0.05	⩽0.5	⩽1.0
Anionic surfactant (=LAS) [mg/L]	⩽0.2	⩽0.2	⩽0.2	⩽0.3	⩽0.3
Sulfide [mg/L]	⩽0.05	⩽0.1	⩽0.2	⩽0.5	⩽1.0
Fecal coliform bacteria [number/L]	⩽200	⩽2000	⩽10000	⩽20000	⩽40000

66. Discharge of wastewater during construction and operation of the railway station is regulated under PRC's *Integrated wastewater discharge standard* (GB 8978–1996). Class I standard applies to discharge into GB 3838–2002 category 3 water bodies. Class II standard applies to discharge into categories 4 and 5 water bodies. Class III standard applies to discharge

into municipal sewers going to municipal wastewater treatment plants (WWTPs) with secondary treatment. No new discharge of wastewater into Categories 1 and 2 water bodies is allowed. Table 6 shows these standards.

67. The revised EIR proposed using sequential batch reactor (SBR) for treatment of wastewater generated from the Xichang West Station during operation, for discharging into the Anning River which is a category 3 water body. The treated effluent from the Xichang West Station must therefore meet Class 1 standard.

Table 6: Standards for discharging wastewater during construction and operation according to GB 8978–1996

Parameter		Class I (for discharging into Category 3 water body)	Class II (for discharging into Categories 4 and 5 water body)	Class III (for discharging into municipal sewer)
pH	no unit	6 ~ 9	6 ~ 9	6 ~ 9
SS	mg/L	70	150	400
BOD_5	mg/L	20	30	300
COD	mg/L	100	150	500
TPH	mg/L	5	10	20
Volatile phenol	mg/L	0.5	0.5	2.0
NH_3-N	mg/L	15	25	---
PO_4^{2-} (as P)	mg/L	0.5	1.0	---
LAS (= anionic surfactant)	mg/L	5.0	10	20

68. **Electromagnetic Radiation**. Xichang West Station will include the construction and operation of a 200 kV electric power traction substation. Requirements on assessment and control of electromagnetic radiation are prescribed in the *Technical guidelines for environmental impact assessment of electric power transmission and distribution project* (HJ 24-2014). However, the control limits of 0.1 mT for power frequency magnetic field and 4 kV/m for power frequency electric field at 50 m from the boundary of the substation that were adopted in the original EIR (approved) based on the superceded HJ/T 21-1998 was agreed by MEE for use on the substations in this project. The WBG has no EHS standard on electromagnetic radiation.

E. Assessment Area (Project Area of Influence), Assessment Period, and Evaluation Standards for the Project

69. The **assessment area**, or the project area of influence, was determined based on potential impact distances of various environmental parameters, the assessment levels assigned by the local environmental authorities for various environmental media, and guidance provided in the PRC's series of technical guidelines for environmental impact assessment (see Table 1, items 45–51). Table 7 shows the assessment areas and the PRC **evaluation standards** adopted for this project.

Table 7: Assessment area and PRC evaluation standards adopted for this project

Type of Standard	Environmental Media	Applicable PRC Standard	Project Area of Influence
Environmental quality	Ambient air quality	Class II standard in *Ambient air quality standard* (GB 3095-2012)	Within 200 m from the boundaries of the construction sites.

Type of Standard	Environmental Media	Applicable PRC Standard	Project Area of Influence
standard	Noise	Functional Area Category 2 and Category 4b standards in *Environmental quality standard for noise* (GB 3096-2008)	Within 200 m from the center of the outermost railway track, with Category 4b standard applicable to within 40 m and Category 2 from 40 m to 200 m.
	Vibration	*Standard of environmental vibration in urban area* (GB 10070–88)	Within 30 m from the center of the outermost railway track.
	Surface water quality	Categories 3, 4 and 5 standards in *Environmental quality standards for surface water* (GB 3838-2002) depending on the water quality category of the water body.	Receiving water bodies for construction impact assessment.
	Ecology	No numerical standard. Assessment based on *Technical guidelines for environmental impact assessment – ecological impact* (HJ 19-2011)	Within 300 m from the center of the outermost railway track, and within 100 m from the boundary of temporary land take areas.
	Physical cultural resources	No numerical standard but controlled under PRC's *Cultural Relics Protection Law* and *Cultural Relics Protection Law Implementation Ordinance.*	"Footprint" of the permanent and temporary land take areas
	Occupational health and safety	No numerical standard but controlled under PRC's *Labor Law* and *Environmental and hygiene standards for construction sites* (JG/J 146-2004)	Construction sites within the "footprint" of the permanent and temporary land take areas
	Community health and safety	No numerical standard	Up to 200 m beyond the "footprint" of the permanent and temporary land take areas
Pollutant emission / discharge standard	Air pollutant	*Air pollutant integrated emission standard* (GB 16297-1996), Class II and fugitive emission standards	Construction sites within the "footprint" of the permanent and temporary land take areas
	Noise	*Emission standard of environmental noise for boundary of construction site* (GB 12523-2011)	Construction sites within the "footprint" of the permanent and temporary land take areas
	Wastewater	*Integrated wastewater discharge standard* (GB 8978-1996): (i) no discharge into Category 2 water bodies, (ii) Class I standard for discharging into Category 3 water bodies, (iii) Class II standard for discharging into Categories 4 and 5 water bodies, (iv) Class III standard for discharging into public sewers. *Standards for irrigation water quality* (GB 5084-2005) for discharging into irrigation ditches.	Sedimentation tank discharge point on construction site and concrete batching station for construction impact assessment. Treated effluent discharge point at the station for operational impact assessment.
	Electromagnetic radiation	*Technical guidelines for environmental impact assessment of electric power transmission and distribution project* (HJ/T21-1998)	Within 40 m from the boundary wall of the 200 kV electric power substation.

70. According to the revised EIR, the **assessment period** covers both the construction and operation stages of the project. The construction stage for the upgrading of the E'mei-Miyi section of the Chengkun Rail Line has been estimated to take approximately 78 months (6.5 years). The **construction period for the Xichang West Station** has been estimated to take 24 months, commencing in April 2019 and completing in March 2021. The operational stage adopts an assessment period of 2025 for the near term and 2035 for the long term, with emphasis on impact assessment for the near term.

F. Justification for the Use of PRC Standards

71. ADB's *Safeguard Policy Statement* (2009) requires projects to apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the WBG's EHS guidelines. Table 8 compares PRC standards with the WBG's EHS guidelines, and concludes that the application of PRC legislated standards was justified. The justification is based on several observations:

72. **The WBG's EHS guidelines endorse the use of internationally recognized standards in case of absence of national legislated standards.** The General EHS Guidelines on Air Emissions and Ambient Air Quality state that "Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should [apply] national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources". The availability of national legislated standards overrides the adoption of other internationally recognized standards. The General EHS Guidelines on Air Emissions and Ambient Air Quality also state that "Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognized sources". The availability of national legislated standards overrides the adoption of other internationally recognized standards.

73. **Some PRC standards are comparable to or more stringent than internationally accepted standards.** Examples include 24-h SO_2 Class I standard, 24-h PM10 Class I and II standards, and annual and 1-h NO_2 Classes I and II standards (see Table 3), which are the same as either the WBG EHS interim targets or AQG. Some PRC standards, such as CO and day time noise, are more stringent than the USEPA standards (see Table 8).

74. **PRC standards are not always comparable to standards suggested in the WBG's EHS Guidelines.** The exposure/averaging time period of some PRC ambient air quality standards are lacking in the WGG's EHS guideline, making comparison not possible. Examples include annual average SO_2 and NO_2 standards for assessing long term and/or regional impacts, and 1-h average SO_2 and NO_2 standards for assessing short term (such as during peak construction activity) impacts (see Table 3). PRC's environmental quality standards for noise are defined for noise functional area categories by taking into consideration influencing factors in the area such as road and rail traffic, and are different to the classification of the EHS guidelines that do not take influencing factors into consideration. A shift to alternative classifications or time periods would require conducting on-site monitoring by nationally accredited environmental monitoring stations, which does not seem to be justified.

75. **Some PRC standards are not defined in the WBG's EHS Guidelines.** Internationally accepted standards are lacking for NH_3 and TSP, which are defined in PRC ambient air quality standards. Other parameters which could not be compared to international standards include surface and marine water quality standards.

Table 8: Comparison of PRC standards with international standards

Parameter	PRC standards	International standards	*Remarks*
Ambient air quality	**GB-3095-2012**	**WHO Air Quality Guidelines Global Update (2005); USEPA**	
TSP	0.12 mg/m^3 (Class I, 24h) 0.30 mg/m^3 (Class II, 24h)	WHO: No standard USEPA: No standard	*No comparison possible*
CO	4.0 mg/m^3 (Class I, 24h) 4.0 mg/m^3 (Class II, 24h)	WHO: No standard USEPA: 10 mg/m^3	*PRC standard is more stringent than USEPA*
NO_2	0.08 mg/m^3 (Class I, 24h) 0.08 mg/m^3 (Class II, 24h) 0.20 mg/m^3 (Class I, 1h) 0.20 mg/m^3 (Class II, 1h)	WHO: 0.04 mg/m^3 (365d); 0.20 mg/m^3 (1h) USEPA: 0.14 mg/m^3 (24h)	*PRC and WHO standards are either not compatible given the different time periods, or the same for same time period. PRC standard is more stringent than USEPA standard*
PM_{10}	0.05 mg/m^3 (Class I, 24h) 0.15 mg/m^3 (Class II, 24h)	WHO: 0.05 mg/m^3 (24h) USEPA: 0.15 mg/m^3 (24h)	*PRC standards are comparable to WHO and EPA standards.*
Ambient acoustic quality standard	**GB-3096-2008**	**World Health Organization (1999)**	
L_{Aeq} (dBA)	45/55 (night/day, Category 1) 50/60 (night/day, Category 2) 55/65 (night/day, Category 3) 55/70 (night/day, Category 4a) 60/70 (night/day, Category 4b)	Class I: 45/55 (night/day) Class II: 70/70 (night/day)	*WHO Class I: Residential, institutional, educational* *WHO Class II: Industrial, commercial*
Surface water quality standard	**GB-3838-2002**		*No comparable standard identified/suggested in the EHS guideline*
COD	15 mg/L (Category 2) 20 mg/L (Category 3) 30 mg/L (Category 4)		
NH_3-N	0.5 mg/L (Category 2) 1.0 mg/L (Category 3) 1.5 mg/L (Category 4)		
TP	0.1 mg/L (Category 2) 0.2 mg/L (Category 3) 0.3 mg/L (Category 4)		
Sea water quality standard	**GB-3097-1997**		*No comparable standard identified/suggested in the EHS guideline*
COD	2 mg/L (Category 1) 3 mg/L (Category 2) 4 mg/L (Category 3) 5 mg/L (Category 4)		
Inorganic. N	0.2 mg/L (Category 1) 0.3 mg/L (Category 2) 0.4 mg/L Category 3) 0.5 mg/L (Category 4)		
Active P	0.015 mg/L (Category 1) 0.030 mg/L (Category 2) 0.030 mg/L (Category 3) 0.045 mg/L (Category 4)		
Noise standards for industrial enterprise boundary	**GB 12348-2008**	**World Health Organization (1999)**	*WHO Class I: Residential, institutional, educational* *WHO Class II: Industrial, commercial*
L_{Aeq} (dBA)	55/45 (day/night, Category 1) 60/50 (day/night, Category 2) 65/55 (day/night, Category 3) 70/55 (day/night, Category 4)	Class I: 45/55 (night/day) Class II: 70/70 (night/day)	
Noise limits for construction sites	**GB 12523-1990**	**USEPA**	*PRC standards more stringent than international standards*

Parameter	PRC standards	International standards	*Remarks*
L_{Aeq} (dBA)	75/55 (Earth works, day/night) 85 (Pile driving, day; banned for night) 70/55 (Structural works, day/night) 65/55 (Exterior and interior finishing works, day/night)	85 (day, 8h exposure)	

III. DESCRIPTION OF THE PROJECT

A. General

76. The project aims to assist the China Railway Corporation (CRC) in developing modern energy efficient and sustainable transport solutions in southwestern PRC. The government is enhancing the capacity of the rail line connecting Chengdu in Sichuan Province with Kuming in Yunnan Province (the Chengkun Rail Line). The project will develop a demonstration multimodal hub[15] in Xichang City (the new Xichang West Railway Station) on the E'mei–Miyi section of the Chengkun Rail Line, improve maintenance systems by introducing modern maintenance equipment, and provide institutional capacity building and training.

77. The E'mei–Miyi section is the middle section of the Chengkun Rail Line. The existing E'mei–Miyi section has a total length of 535 km, with 61 stations and approximately 12 passenger trains and 23 cargo trains each way per day. The proposed capacity enhancement of the E'mei–Miyi section totals 392 km (consisting of 386 km main line and 6 km branch line). Capacity enhancement of the rail line consists of construction of a second track totaling 5.5 km from E'mei to Yangang (total two tracks) and construction of two new tracks totaling 378 km from Yangang to Miyi (total three tracks). The operational intent is to use the existing track for a few slow passenger trains and freight trains, and the new tracks for fast passenger and freight trains. Train speed would be increased from the present 60 km/h to 120 km/h for freight trains and 160 km/h for passenger trains. Construction duration for the capacity enhancement of the E'mei–Miyi section is expected to take approximately 6.5 years, from 2016 to 2022. Construction of the new Xichang West Station is expected to take 24 months, scheduled to occur from April 2019 to March 2021.

B. Project Rationale

78. Railway development in the PRC. The railway subsector is vital to the economic and social development of the PRC, its international trade, continued economic growth, intercity connectivity, and ability to extend the benefits of development to people living in the more remote regions of the country. The PRC is a vast country where people and goods move over long distances and railways provide the most economic means of transport. During 2000 – 2016, the (conventional) railway network expanded by 55%, from 66,000 kilometers (km) to 102,000 km.

79. Despite its impressive growth in recent years, the railway transport capacity is still unable to satisfy the needs of domestic and freight transportation. This constrains economic growth, particularly in the poorer land-locked south-western region. The government recognizes the virtues of the railway as a cheaper, safer, and fuel-efficient transportation mode. It has the potential for greater speed and the capacity to provide demand-responsive sustainable development along core economic corridors without taking much land area if properly planned

[15] The term "multimodal hub" generally refers to any facility that caters to more than one mode of transport.

and developed. In the Thirteenth Five-Year Plan, the Government has placed special emphasis in expanding the railway network, to promote sustainable development by enhancing railway provision in poorer and undeveloped provinces. The plan envisages removing existing constraints in railway traffic carrying capacity and enhancing railway development in the western region by developing inter-city rail networks.

80. Railway development has lagged in the south-western region owing to the highly mountainous terrain which makes railway construction very difficult and challenging. The existing line connecting the capital cities of Yunnan and Sichuan provinces was constructed in 1970. It's a single-track line with operating speeds in the range of 40–60 km per hour. It has been operating at near full capacity for more than 10 years. To expand capacity across the south-western region of the PRC, a new railway line is being developed. The new Chengdu–Kunming railway line (CKRL) involves the construction of 860 km (645 km in Sichuan and 215 km in Yunnan) of railway line for passenger and freight transportation. When completed, CKRL will improve the competitiveness of local products, enhance tourism development, and support urbanization.

81. Need for integrated and energy efficient multimodal hubs. In PRC, the new railway stations often do not satisfy the needs of the passengers. These are often located far from city centers and are not well integrated with the city transport systems. Thus, while the new railway lines will facilitate faster intercity travel, the stations also need to be efficiently linked to the existing city with well-designed multimodal transport infrastructure and high-quality integrated public transport services. This will enhance the quality of the journey experience for passengers and will encourage increased use of public transport. This will ensure a reduction in transport costs, increase travel opportunities and regional accessibility to jobs and services, and promote economic development and poverty reduction.

82. The government also recognizes that better integration between railways and other transport modes is important in creating an efficient transport system. A key challenge is to improve multimodal connections between railway passenger services and urban passenger transport at railway stations in medium sized and large cities. The multimodal hub can serve as the focal point for integration of various transport modes and provide seamless connectivity between and within cities, convenient passenger travel experience, and energy efficient building technology.

83. Railway stations or multimodal hubs play a crucial role in facilitating a good travel experience for passengers. Multimodal interchange hubs are vital for achieving sustainable transport systems. They stitch together different modes of transport and serve as the gateway to mobility and greater accessibility. A well-designed hub can significantly enhance the overall journey experience of passengers. The new line will include 18 railway stations or multimodal hubs. One important hub on this line will be developed in Xichang city which has a population of about 775,000. It is rich in agriculture products and food processing industries, is also one of the centers of the PRC's space satellite program and is a famous tourism city drawing large numbers of domestic tourists every year. Developing Xichang into a well-designed multimodal hub could have a huge demonstration impact for the region.

84. One of the most important strategic objectives of all development initiatives in the PRC is the reduction of energy consumption and carbon emission across sectors. In the PRC, for example, buildings alone consume over 20% of the total energy produced, and a shift toward green buildings is of great importance. With the rapid development of the railway subsector in the PRC, the number of stations now exceeds 5,000, so it is important for the railway sector to pay

sufficient attention to the use of energy in the station buildings. Railway stations can be developed as a model to demonstrate best practices in energy efficiency.

85. Ensuring sustainability through improved maintenance. Good maintenance practices are an integral part of providing competitive, high quality, and reliable transportation for people and goods. The entire network of PRC railways is managed and maintained by 18 railway bureaus. These railway bureaus are wholly owned and controlled by CRC. The new CKRL line will be managed and maintained by Chengdu Railway Bureau (CRB). By the end of 2016, the network size under CRB had reached 9,100 km. Of this about 2,100 km of track had an operating speed of 200 km per hour and above and the remaining 7,000 km was ordinary railway track. The volume of passenger traffic carried was 210 million passengers, and freight 190 million tons.

86. The railway lines managed by CRB are typical mountain railway lines, with cliffs and steep slopes. The geological situation is complex, and the topography and landscape are hazardous. The difficult and dangerous terrain poses huge challenges for conventional maintenance systems rendering the maintenance tasks extremely arduous. Over 1,500 km of the network has curves with a radius of less than 600 meters, which causes rapid track wear and deformation and requires careful monitoring. In contrast, the existing maintenance machines and inspection equipment are quite basic and insufficient. The capacity of the maintenance staff is limited, and maintenance teams of the railway bureau often struggle to catch up with the rapidly growing network which is increasingly difficult to maintain owing to the surge in operating speeds.

87. Regional Cooperation. South Western PRC has good economic complementarities with Southeast and South Asian countries, and bilateral trade is growing rapidly. Bordering on Viet Nam, Lao People's Democratic Republic (Lao PDR), and Myanmar, the provinces of South Western PRC have strong location advantages and form a regional cooperation link between PRC and Association of Southeast Asian Nations (ASEAN). After completion of the CKRL, the new railway will, together with pan-Asia railway, constitute an international railway channel, connecting PRC with Myanmar, Viet Nam and Lao PDR, playing a key role in strengthening communication and trade between PRC and Southeast Asia and South Asia, and promoting development of PRC–ASEAN free trade area. The development of this railway line is a major initiative for this region and ADB is already providing assistance for developing the safety aspects on this line. PRC further needs assistance in ensuring that the line is properly integrated with other transport modes through well designed multimodal hubs and its sustainability is ensured by having an improved maintenance system in place.

88. Strategic priorities. This project is aligned with the strategic priorities of the Country Partnership Strategy 2016–2020 for the PRC in supporting inclusive economic growth as the project is in a lesser developed region i.e. Sichuan province in southwestern PRC. The proposed project will help the PRC address the challenges highlighted above and deepen the cooperation between the government and ADB by helping to develop the rail transport mode into a sustainable transport system for freight and passengers. The project is in line with ADB's Sustainable Transport Initiative, which highlights railway development as an important opportunity for sustainable transport operations. The railway development is consistent with the Thirteenth Five-Year Plan's objectives of balanced development of rural and urban areas, better transport connectivity, and inclusive urbanization. The CKRL is also part of the government's Silk Road Economic Belt initiative9 and PRC's latest medium- and long-term railway network plan, which seeks to improve the railway system, especially in the central and western PRC.

89. Value added by ADB assistance. The CRC has been promoting the development of multimodal hubs and the use of modern rail maintenance technologies and equipment consistent

with the requirements of South Western PRC. It is seeking to attract foreign technology and expertise to meet these needs, an area where the Asian Development Bank (ADB) can play a significant role and has in the past helped the government through a technical assistance.

90. ADB will also support the development of the multimodal hub in Xichang City. The cost of financing a single multimodal hub is small but a well-designed hub on an important railway line could have a significant demonstration effect. ADB's value addition will include use of recycled materials to ensure sustainable construction, extensive use of renewable energy sources and energy efficiency features in building design and excellent connectivity between different transport modes to facilitate intermodal transfers for passengers. CRC have confirmed that they welcome ADB's involvement in the detailed design of the hub and are keen to develop Xichang as a best practice example for the region.

91. ADB's financing will procure modern track maintenance equipment that could yield enormous benefits. For example, investing in a high-quality maintenance systems would ensure that reliability and operational efficiency of train operations is improved. The capacity building component will assist in developing a strong overall vision and an integrated approach to maintenance systems, which is needed to maintain the intensively used railway infrastructure. ADB's involvement will also help to enhance the importance of maintenance systems, which have in the past been given a relatively low priority vis-à-vis the construction of new railway lines in PRC.

C. Component 1: Development of Multimodal Hub at the Xichang West Railway Station

92. This component consists of the construction and operation of a multimodal passenger hub in Xichang (the new Xichang West Station) on the E'mei–Miyi section of the Chengkun Rail Line (see Figure 1 on location). According to the urban master plan of Xichang City (2011–2030), Xichang will be developed as a vacation tourism destination in western PRC featuring ecology, aerospace and ethnic customs. The projected population of Xichang City by 2030 and 2040 would be 1.1 million and 1.34 million respectively. The annual passenger throughput at the Xichang West Station has been predicted to reach 5.99 million in 2030 and 8.12 million in 2040.

93. The Xichang West Station will be built in Xichang's newly urbanized area, approximately 10 km west of the existing city center and 13 km southwest of the Xichang Qingshan Airport (Figure 2). There will be three urban road corridors connecting the Xichang West Station with the existing urban center (Figure 3). Caizishan Road will be the major route since it has the shortest distance among the three. Based on Xichang City's public transport planning, Xichang West Station could also be connected by tram or rapid bus transit (BRT) to the future demand. Planned developments around the Xichang West Station would include residential and commercial areas (Figure 4).

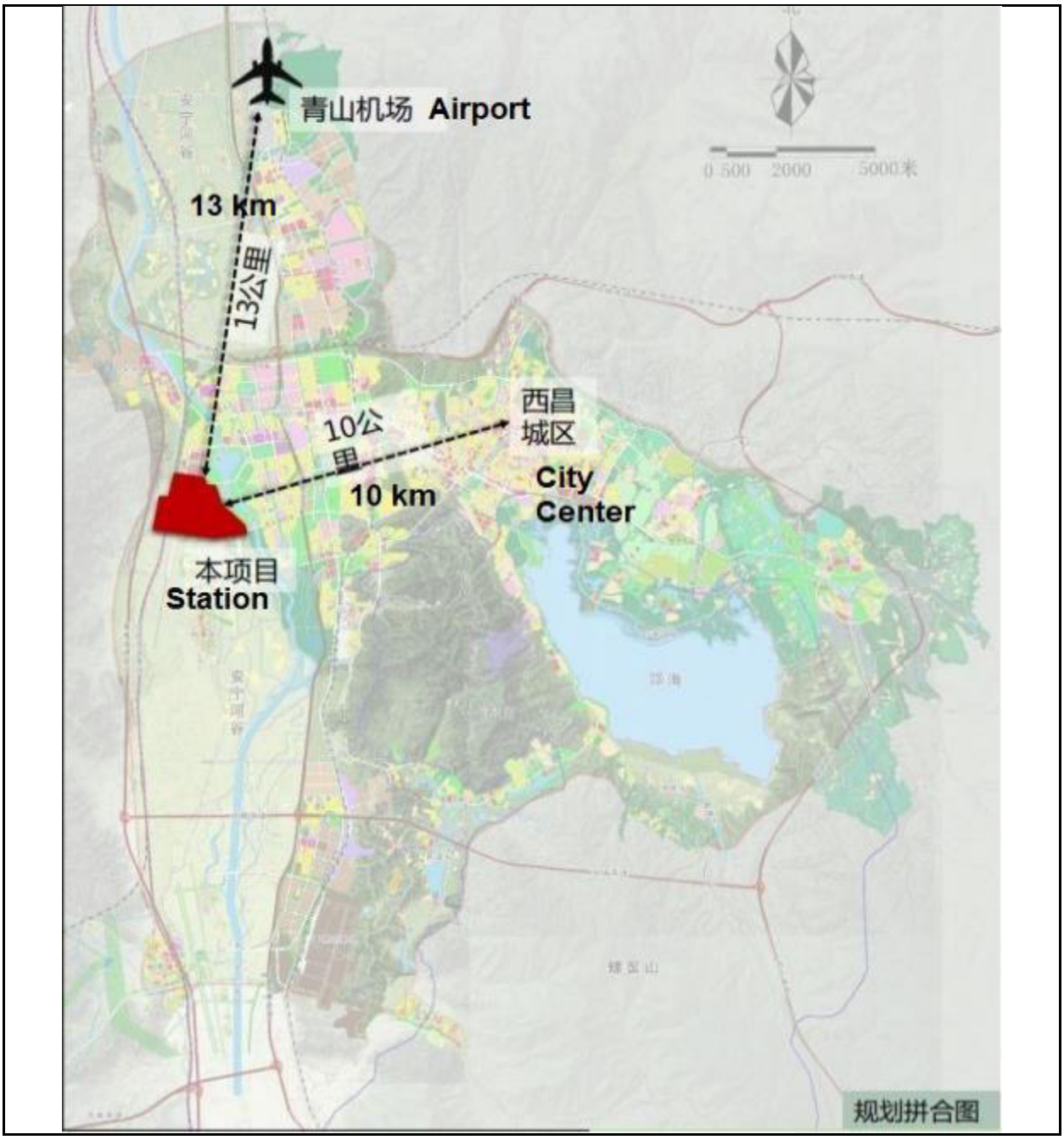

Figure 2: Location of the Xichang West Station in Xichang City

Figure 3: Planned roads connecting to the Xichang West Station

Figure 4: Development plan around the Xichang West Station

94. The building area of Xichang West Station would be 15,000 m^2. The station and other transport modes will be kept in seamless connection to provide convenience and interconnectivity. The square east of the station building (the area between the station and Caizishan Corridor shown in Figure 4 above) would function as a transfer interchange center for railway station and other related transport modes such as city bus station, taxi stop and long distance coach terminals.

95. Figure 5 shows the layout of the Xichang West Station and the railway tracks. Preliminary design of the station has assumed the boundary of the station to extend from chainage DK431+000 to chainage DK433+769.011. The station is designed with four platforms and nine tracks (including two main lines). The effective length of the incoming-outgoing track is designed as 880 m. The station design includes three 550 m x 11 m x 1.25 m intermediate platforms, a 550 m x 12 m x 1.25 m basic platform, two 8-m wide passenger underpasses, and passages for luggage and mail bags. Space on the west side of the station is reserved for future expansion to accommodate high speed rail (HSR) connection, which is not considered in this project at this stage.

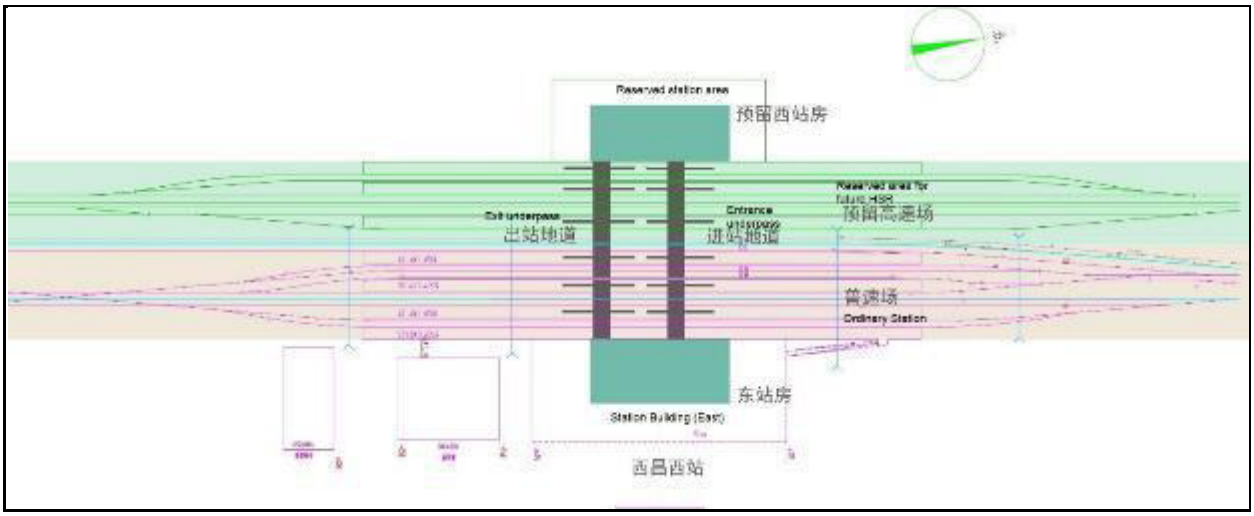

Figure 5: Xichang West Station plan

96. The proposed design of the Xichang West Station combines the latest technology and local features. The design approach could be called “the moon arising from the sea”, which means that the arch-shaped roof looks like the moon while the building roof is like the sea level. Glass materials would be widely used for the roof and walls for energy saving and aesthetics. Xichang City is located in the subtropical plateau with over 2,400 hours of sunshine annually. The electricity consumption of railway stations is relatively large and stable. The station is therefore favorable for the installation of distributed photovoltaic power devices on the rooftop. To provide electricity to the trains, a 220 kV traction substation will be constructed. Figure 6 shows a photomontage of the proposed Xichang West Station. Figure 7 shows the proposed layout of the station areas. These areas are described below.

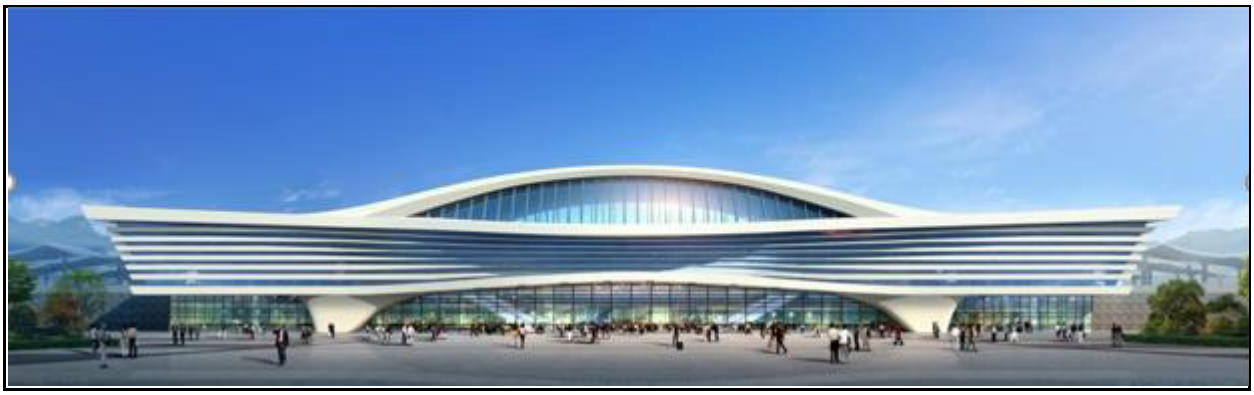

Figure 6: Photomontage of the Xichang West Station

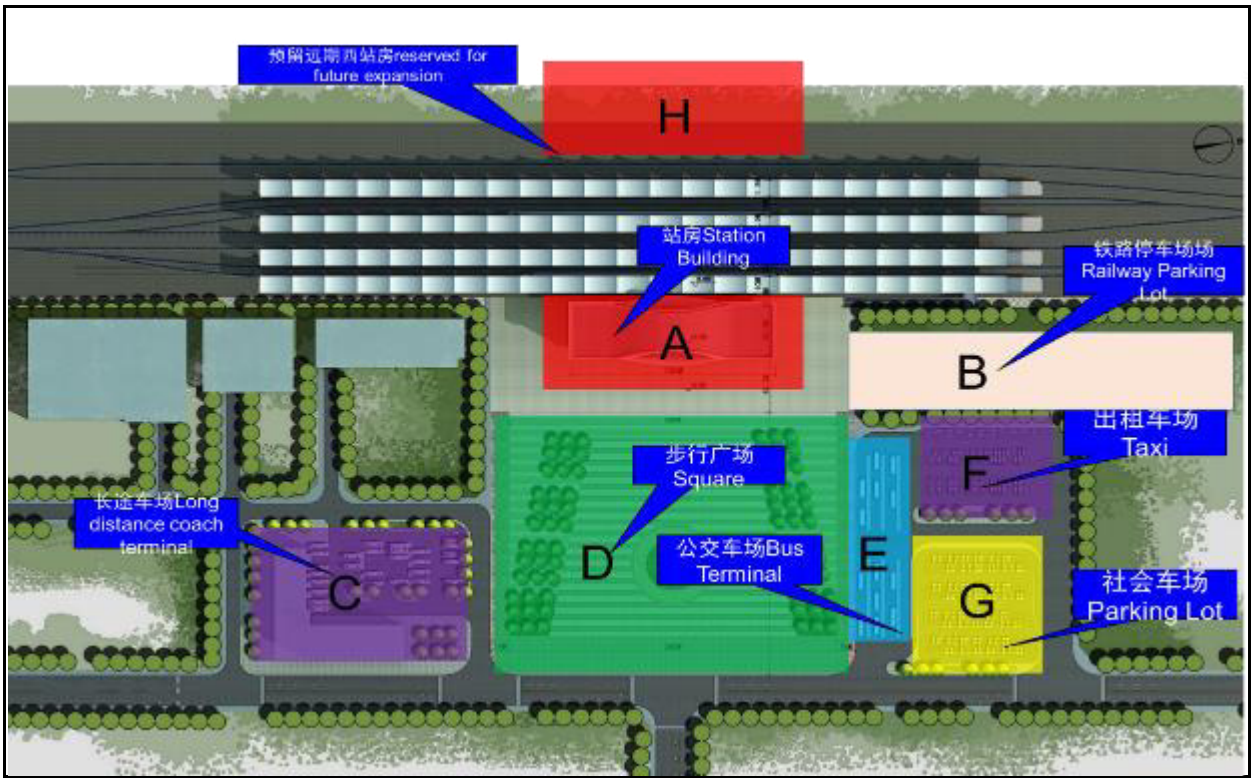

Figure 7: Proposed layout of the Xichang West Station areas

97. **Area A: Station Building**. The station building will be the core of all the facilities and will play the most important role. It is where passengers wait, depart and arrive in Xichang. The station building will have a floor area of 15,000 m^2, taking up a land area of 11,380 m^2. Figure 8 shows the internal layout of the first and second floors of the station building and how the passengers flow between the station building and the platforms. The first floor mainly comprises of the waiting area, ticketing office, luggage room and offices. The second floor mainly comprises of the waiting area, offices, and ancillary facilities housing machines and equipment for railway operation. The waiting areas could accommodate a maximum of 2,000 passengers.

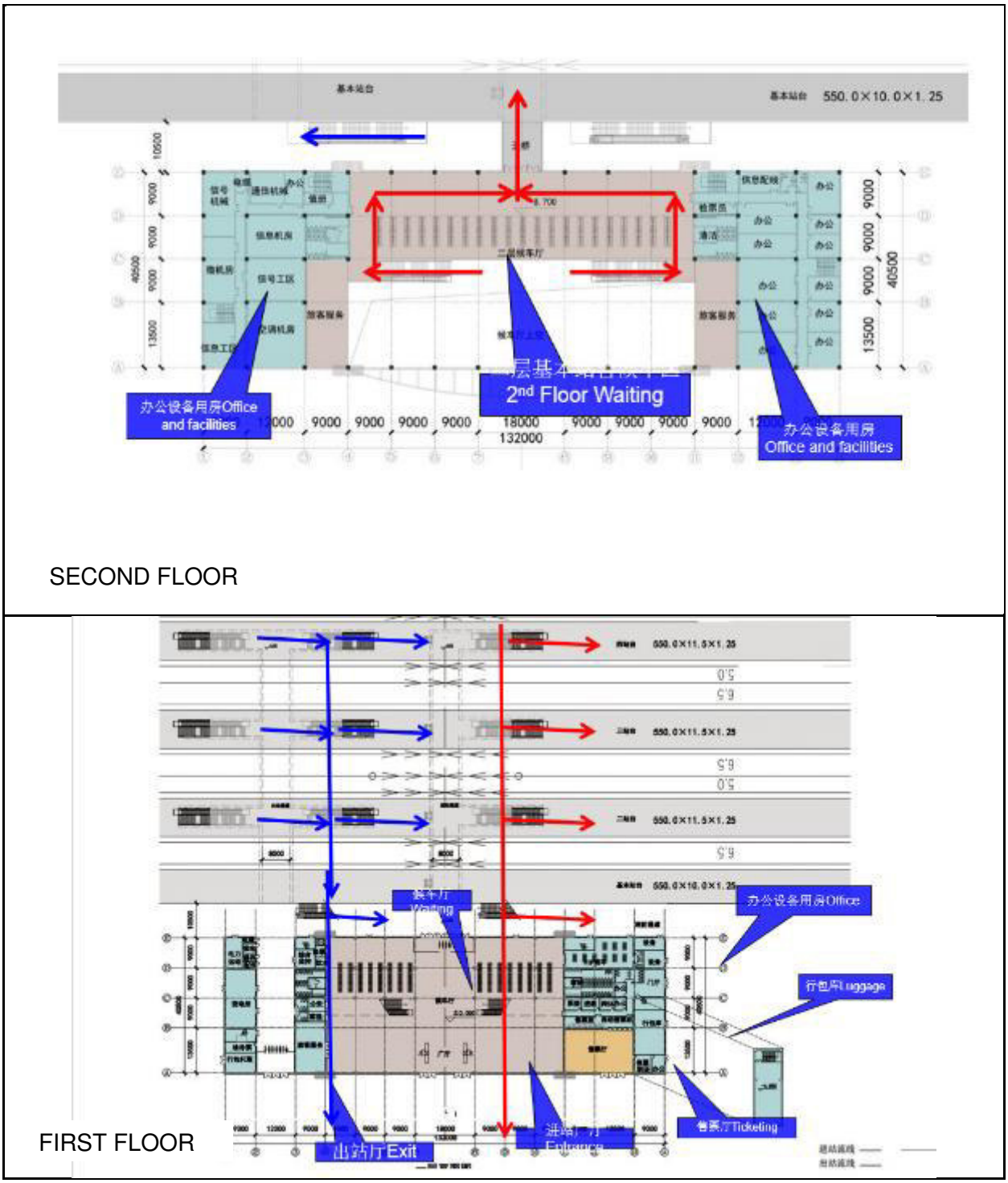

Figure 8: Internal layout of the station building and platforms showing passenger flow

98. **Area B: Railway Parking Lot**. The railway parking lot would be restricted to the parking of vehicles related to railway operation. It is envisaged that car-sharing business and facilities could also be located in this area in the future, so that passengers could conveniently access the share cars upon arrival or before departure. With a land area of 16,000 m^2, it could accommodate around 350 cars.

99. **Area C: Long Distance Coach Terminal**. This terminal connects to the central square of easy access. Train passengers can transfer to the long distance coaches seamlessly.

100. **Area D: Central Square**, This is a multifunctional area and is usually the most distinctive feature of railway stations in the PRC. It can be used by people as a waiting area for trains and other modes of transport, as well as a public space for neighboring communities. The square provides a nice place in the evening for square dancing and relaxing, a value added feature provided by the railway station to the local communities.

101. **Area E: Bus Terminal**. This terminal provides railway passengers easy connectivity to public buses going to various destinations in Xichang City. BRT is also envisaged in the future to further improve the transfer to and connectivity with the city.

102. **Area F: Taxi Station**. The same as the bus terminal, the taxi station offers alternative transport modes for passengers going to various destinations in Xichang City.

103. **Area G: Parking Lot**. This parking lot is for public use. People can drive to the station and park their cars here.

104. **Area H: Reserved Area for Future Expansion**. This area is reserved for future expansion to accommodate the high speed rail. Figure 9 shows the reserved area as well as a cross-sectional view of the station building connecting to the tracks and platforms with indications of passenger flow.

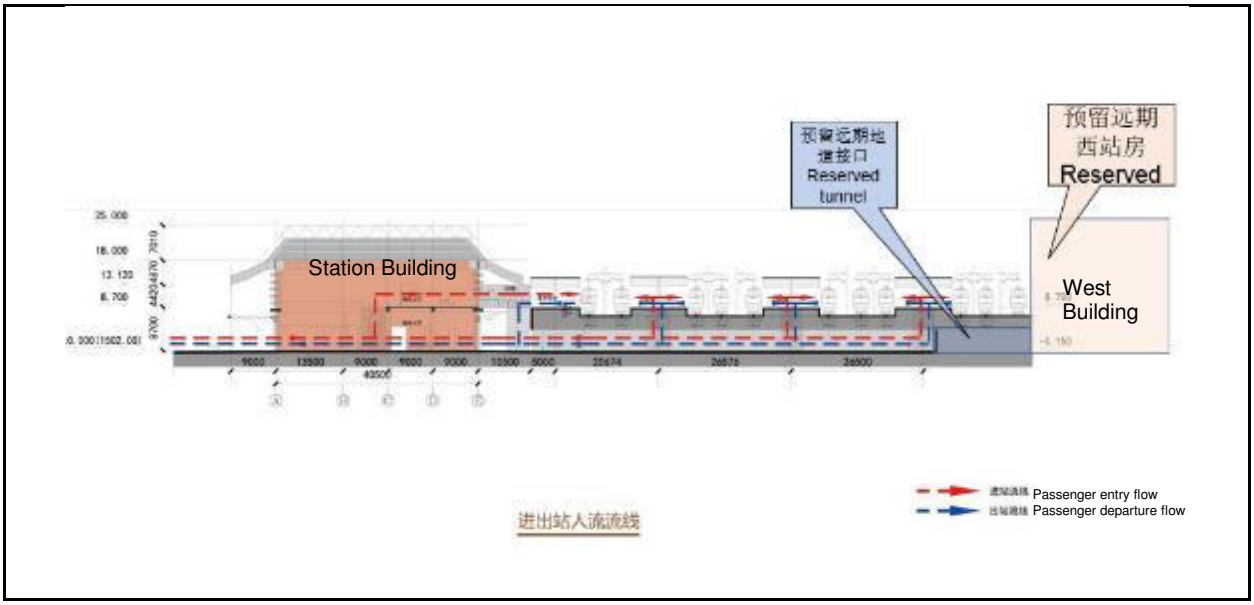

Figure 9: Cross section of Xichang West Station

D. Component 2: Procurement and Commissioning of Railway Maintenance Equipment

105. Track renewal and track laying operations require high expenditure for personnel and machines. These costs could be substantially reduced by adopting mechanized working methods. High quality could also be achieved at the same time. The goal of this component is to impact the railway track performance by facilitating increased availability, reliability and safety, along with

decreased maintenance cost. This component will procure modern track machines, including equipment for track inspection and repair, and for rescue and restoration (Table 9).

Table 9: Summary on equipment procurement

	Item to be Procured	Quantity
A	**Maintenance equipment**	
1	Three platform high speed tunnel inspection vehicle	11
2	1000 kw electrical rail car	5
3	270 kw rail car	30
4	300 kw rail car	15
5	Fast rail change car	2
6	Continuous three sleeper tamping vehicle	4
7	Dual power grinding vehicle	1
8	Large scale maintenance machine malfunction dynamic and visible inspection system	1
9	Accident relief commanding vehicle	1
10	Hydraulic drilling machine	2
11	Vertical grinding vehicle	12
12	Small track grinding vehicle	12
13	Hand held Eddy current scanner	13
14	Eddy current inspection machine	12
15	Fast rail measuring machine	10
16	Level 0 track inspection car	19
17	Mini profiler	55
18	Corrugated wear inspection car	4
19	Geosynthetic reinforced soil comprehensive measuring system	4
20	Mobile underwater topographic survey system	5
21	Shallow water wave detection system	1
22	Multi-channel dynamic and static strain gauge	3
23	Wireless bridge vibration detection system	4
24	High definition measurement robot	3
25	Laser holographic imaging system for tunnels	2
26	Concrete perspective instrument	4
B	**Locomotive maintenance equipment**	
1	Rescue crane	3
C	**Power supply equipment**	
1	Catenary inspection vehicle	7
2	Catenary operating vehicle	3
3	Aerial operating vehicle	1

106. Figure 10 shows examples of maintenance equipment to be procured. Railroads use ballast to form the track bed, which bears the train load. Ballast facilitates proper drainage under the rail track and helps prevent vegetation from growing over the rails. The proposed machines are designed for major maintenance situations that normally would require several pieces of equipment. With different attachments and the ability to work on or off track, using one integrated machine could complete the job. The track renewal train (also known as trach renewal system or new track construction machine) is a work train that consists of many units of machinery and materials required for track renewal (rail and sleeper replacement). The track renewal process will be completed stage by stage as the track renewal train moves forward.

Figure 10: Examples of equipment to be procured

107. Railroad crane shown in Figure 10 is used for accident recovery work. Once an accident occurs, the crane could be dragged by a locomotive to the accident site for lifting an removing the trains and other materials blocking normal operation. The crane could substantially reduce the workload of the rescue team and improve the rescue efficiency. The inspection car is a self-propelled vehicle and is used for *ad hoc* inspection, patrolling and maintenance of traction overhead equipment, and attending to sites of breakdown for restoration of damaged overhead equipment. It is specially used during night time for electric current collection tests in order to ascertain safe contact between pantograph of electric locomotive and contact wire of the overhead equipment. This multi-functional vehicle could substantially improve efficiency, reduce manpower used for overhead equipment inspection, and reduce down time.

108. This will support capacity building on railway maintenance measures and training on advanced railway maintenance systems (Figure 11), including occupational health and safety training. Taking into consideration risks of accidents during railway maintenance works, highly skilled staff with regular safety training will be limited to the maintenance work. The provision and the use of appropriate personal protection equipment will be strictly applied.

Figure 11: Capacity building on railway maintenance systems

E. Climate Change Adaptation Considerations

109. The project - Xichang West Station was considered as the project area. Based on the climate risk screening, the project was classified as medium risk. A Climate Risk and Vulnerability

Assessment (CRVA) was prepared (Appendix 2). The conclusion of CRVA shows that the Xichang West Station has potential flood risk due to increased intensity of rainfall. To avoid costly maintenance and/or business disruption in the future, the Xichang West Station should consider additional flood risks induced by the climate change impact in designing the project engineering works e.g. sufficient drainage system. During the detailed engineering design, a hydraulic modelling be carried out to assess floor risk at Xichang West Station.

F. Associated Facilities

110. The construction and operation of the Xichang West Station under ADB funding is part of the capacity enhancement of the E'mei–Miyi section of the Chengkun Rail Line. The construction and operation of the E'mei–Miyi rail line is regarded as an associated facility of this project. The environmental due diligence on the associated facility was thoroughly carried out under the Loan-3556: PRC Mountain Railway Safety Enhancement Project, which was approved on August 2017. The audit report on the E'mei-Miyi line was disclosed at ADB website since March 2017 (https://www.adb.org/projects/documents/prc-42019-013-sddr).

IV. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

A. Sensitive Receptors

111. Table 18 lists two receptors that are potentially sensitive to air quality, noise and electromagnetic radiation impacts during the construction and operation of the Xichang West Station. Eight four households mostly 2-storey brick houses built between the 1990's and the present time were found to be located within 200 m from the project site, with 11 households in Zhongxin Village / Xinfu Village located within 30 m from the project site.

Table 18: Air quality, noise, vibration and magnetic radiation sensitive receptors in the vicinity of the Xichang West Station

No.	Name	Chainage	Nearest Distance to Station	No of Households			Description
				<30 m	30m - 60m	60m-200m	
1	Taihe Village and vicinity (太和村及附近)	DK430+650 to DK431+800	34 m	0	1	37	Mostly 1 to 2 storey brick houses built between the 1990's and now
2	Zhongxin Village / Xinfu Village and vicinity (中心村/新富村及附近)	DK432+750 to DK434+150	30 m	11	8	27	Mostly 1 to 2 storey brick houses built between the 1990's and now

Source: Revised EIR.

112. The revised EIR identified the following sensitive ecological, visual and cultural heritage receptors in the vicinity of the E'mei–Miyi section of the Chengkun Rail Line. None of these receptors is within the assessment area (project area of influence) of the Xichang West Station.

B. Physical Setting

113. **Topography and Terrain.** The E'mei–Miyi section traverses through landform consisting mainly of tectonic denudated mountains of high to medium heights and river valley terraces. The tectonic denudated mountains are controlled by the Sichuan-Yunnan meridional structural system as well as in part by the Qinghai-Tibet plateau Yunnan-Burma northwestern Z-shaped tectonic structure. The western and eastern regions, divided by the Anning River, belong to the Daxue

Mountain system and the Daliang Mountain system respectively, with mountain ranges that have been seriously carved up by rivers. The Anning river valley is the main river terrace. The topography along the E'mei–Miyi section has an altitude difference of 1,400 m, ranging from 400 m to 1,800 m. Elevation at the Xichang West Station is 1,500 m.

114. **Geology.** According to the *Regional Stratigraphy Table of Sichuan Province*, the E'mei–Miyi section lies within the E'mei Subzone of the South China Stratigraphy Zone, developed by the Sinian System volcanic rocks. The Palaeozoic Era was dominated by marine deposits, with imperfect strata succession. The Mesozoic Era continental stratum has more uniform strata succession with distant source characteristics. The stratigraphic structure is complex characterized by tight anticlines and loss synclines, dominated by high angle thrust faults developed from the core of the anticline with the fault face leaning northeasterly.

115. The exposed strata along the E'mei–Miyi section, from new to old, consist of Holocene Series (Q_4), Epipleistocene Series (Q_{3+2}), Neogene System Xigeda Formation, Cretaceous System, Jurassic System, Triassic System, Permian System, Devonian System, Silurian System, Ordovician System, Cambrian System, Sinian System, Lower Proterozoic and intrusive rocks.

116. Main adverse geologic conditions along the E'mei–Miyi section include landslide, rock piles, dangerous rock fall, mudslide, karst, bedding slope, riverbank erosion and high seismic intensity areas. Special geotechnical features include man-made spoil, expansive soil, soft soil, mellow soil, plaster and salt rocks.

117. **Seismicity**. According to the *China seismic ground motion parameters zoning map* (GB 18306-2001) Amendment 1, the seismic intensity scales along the E'mei–Miyi section range from VII to IX. The seismic intensity scale around the Xichang West Station area is VIII. The PRC classifies seismic intensity into 12 scales under the *China seismic intensity table* (GB/T 17742-2008), from Scale I to Scale XII based on increasing severity of "shaking" of the earth surface and the extent of potential effect on senses of people on the ground and buildings. Scale VII is intermediate with most people feeling unable to stand stably and with moving home furniture and items. For Scale VIII, most people would sway with difficulty walking, and damage to houses would range from medium to limited serious. For Scale IX, moving individuals would likely fall down with mostly medium to serious damages to houses. However, seismic intensity scales do not define damages to rail infrastructure. Rail infrastructure design must comply with the *Code for seismic design of railway engineering* (GB 50111-2006, 2009 edition). The Xichang station design is strictly complied with the PRC seismic scale VIII.

118. **Climate**. Xichang is located in the southwestern part of Sichuan Province exhibiting the characteristics of subtropical moist climate, subtropical semi-moist climate, and subtropical high altitude monsoon climate. Table 19 presents selected weather statistics recorded in Xichang City. The annual average temperature is 17.2 °C with the highest monthly average of 24.5 °C in the summer and the lowest monthly average of 6.7 °C in the winter. Extreme high temperature and extreme low temperature recorded are 36.6 °C and -3.5 °C respectively. The annual average precipitation is 1,025 mm, with annual maximum of 1,549 mm, monthly maximum of 539 mm and daily maximum of 129 mm. The annual average evaporation is 1,924 mm, which is higher than the annual average precipitation.

Table 19: Weather statistics in Xichang City

Temperature (°C)	Annual average	17.2
	Extreme high	36.6
	Extreme low	-3.5
	Highest monthly average	24.5
	Lowest monthly average	6.7
Relative humidity (%)	Annual average	61
Precipitation (mm)	Annual average	1025
	Annual maximum	1549
	Monthly maximum	539
	Daily maximum	129
Annual average no. of days with precipitation (day)		122
Evaporation (mm)	Annual average	1924
	Annual maximum	2128
Wind speed (m/s)	Annual average	1.5
	Maximum speed & direction	22.9NNW
Annual average no. of days with snow (day)		3.5
Annual average sunshine hours (h)		2266
Annual average no. of days with fog (day)		0.1
Annual average no. of days with storm (day)		61.7

119. **Air Quality**. Both the EIR and revised EIR cited routine monitoring data published by the local EPBs for demonstrating the existing ambient air quality conditions. Ambient air quality data published by local EPBs in the Liangshan Prefecture showed compliance with Class II standards. Data collected in September 2013 from Xichang City showed 24-h average PM_{10} of 0.022-0.115 mg/m^3, 24-h average SO_2 of 0.023-0.112 mg/m^3, and 24-h average NO_2 of 0.020-0.039 mg/m^3.

120. **Acoustic Environment**. According to the revised EIR, baseline noise monitoring carried out at Taihe Village recorded day time noise level of 51.7 dB(A) and night time noise level of 43.2 dB(A), which complied with PRC's GB 3096-2008 standard for category 2 noise functional area as well as WBG EHS standard. Baseline noise monitoring carried out at Zhongxin Village / Xinfu Village recorded day time noise level of 53.4 dB(A) and night time noise level of 45.2 dB(A). Both day time and night time noise levels complied with PRC's GB 3096-2008 standard for category 2 noise functional area. While day time noise level complied with WBG EHS standard, the night time noise level exceeded the WBG EHS standard by 0.2 dB(A).

121. **Surface Water Quality**. The Xichang West Station is at a distance of approximately 1.5 km from the Anning River, which is the nearest water body to the station with surface water quality designated as category 3. Table 20 shows that selected surface water quality parameters monitored complied with GB 3838-2002 standard for category 3 water body.

Table 20: Baseline surface water quality monitoring results

River	**Monitoring Location**	**Surface Water Quality Parameter Monitored**					
		pH	**COD (mg/L)**	**BOD_5 (mg/L)**	**NH_3-N (mg/L)**	**TPH (mg/L)**	**SS (mg/L)**
Anning River	Manshuitan	7.4 – 8.3	8.6	1.4	0.19	0.014	---
	A'qi	7.2 – 7.8	15.4	2.5	0.49	0.016	---
GB 3838-2002 Category 3 standard:		**6 - 9**	**⩽20**	**⩽4**	**⩽1.0**	**⩽0.05**	**---**
Note: Anning River monitoring data were based on the annual averages of 2013 data.							

Source: Revised EIR.

C. Biological Resources, Ecology and Biodiversity

122. Biological resources and protected areas within the ecological assessment area of the capacity enhancement of the E'mei–Miyi section have been described under the section on associated facilities. The Xichang West Station would not impinge onto ecologically sensitive or protected areas listed in Table 13 above. None of the protected species listed in Table 12 above has been recorded within the station's project area of influence. The station sites do not have any old tree, critical or natural habitat. The station site of approximately 40.09 ha is dominated by cultivated land (99.5%) with the remaining 0.5% being rural homestead. Cultivated crops include rice, vegetables, corn, potato and beans. Figure 13 shows the cultivated land at the Xichang West Station site.

Figure 13: Photos of cultivated land at the Xichang West Station site

D. Socioeconomic Conditions

123. Xichang City has an administrative area of 2,651 km^2 and a population of 775,000 among which approximately 23% are ethnic minorities dominated by the Yi ethnic group. It has an urbanization rate of approximately 56%. Its GDP per capita of CNY 56,010 was the highest among all cities / counties in the Liangshan Yi Autonomous Prefecture and was also higher than the Sichuan provincial average of CNY 35,046 and the national average of CNY 46,351[16].

124. The region served by the E'mei–Miyi section is rich in **mineral resources**, including sodium sulfate, phosphate, gypsum, porcelain clay, lime rock, quartz sand and light rare earth metals etc. Superior minerals include vanadium, titanium, tin and magnetic iron. The region is also rich in **tourism resources**. Qionghai in Xichang City has the second largest lake in Sichuan Province.

125. The region along the E'mei–Miyi section provides suitable conditions for **agriculture**. Main agricultural products are food crops and economic crops. Major food crops include rice, wheat, rapeseed, corn, yam, potato, ginger, garlic, kidney beans, mango and guava. Economic crops include tea, Chinese medicinal herbs such as Huanglian (*Coptis chinensis*) and Duzhong (*Eucommia ulmoides*), edible mushrooms and bamboo shoots.

E. Physical Cultural Resources

126. The revised EIR has reviewed and confirmed that no physical cultural resource as defined in SPS (2009) has been found to occur within the footprint of the Xichang West Station site. Should buried artifacts of archaeological significance be uncovered during the construction stage

[16] Based on *Statistics of national economy and social development 2014*.

within the project areas, construction will be stopped and the discovery will be immediately reported to the local cultural bureaus in accordance with the PRC's *Cultural Relics Protection Law* (2002) and the *Cultural Relics Protection Law Implementation Ordinance* (2003).

F. Greenhouse Gas Emissions

127. Sichuan Province has been active in reducing GHG emissions. In 2014, the Sichuan Provincial Government issued an action plan for energy conservation, emission reduction and low carbon development[17]. It set forth targets for emission reduction for 2014 and 2015, and elimination of obsolete and energy consuming industries. It emphasized the promotion of carbon reduction in transportation, industrial and commercial sectors. In 2016, the provincial Energy Conservation and Emission Reduction Office indicated that NO_x emission in the province totaled 534,300 t, which reflected an 8.73% reduction over the 2014 total and more than meeting the 2015 and *Twelfth Five-Year Plan* targets[18].The Province's *Thirteenth Five-Year Plan on economic and social development* emphasized the promotion of clean energy and climate change adaptation and mitigation, and aimed to establish a carbon trading center for western PRC in the province. In August 2016, the Sichuan Development and Reform Commission issued the Interim Method for Carbon Emission Trading in Sichuan[19], for the supervision and management of carbon trading in the province, including the management on assigning emission quotas.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Positive Impacts and Environmental Benefits

128. The project will involve the construction and operation of the Xichang West Station on the E'mei–Miyi section of the Chengkun Rail Line. This station is a key multimodal passenger hub of the rail line. Positive impacts and environmental benefits therefore include benefits from the capacity enhancement of both the rail line and the station from regional and local perspectives.

129. The construction of the Chengkun Rail Line will become an important infrastructure development, playing an important role in driving regional and local sustainable economic development. It is an important channel connecting Sichuan Province and northwestern region with Yunnan Province and Southeast Asia. It will directly improve linkages with the GMS and provide opportunities facilitating greater economic integration with PRC's dynamic eastern seaboard and the national economy as a whole.

130. Ethnic minorities from Qiang, Yi and Zang groups, who are agriculture and livestock dependent, are among the major direct beneficiary groups. The Yi is the overwhelming majority ethnic group in the three poorest counties in the vicinity of the E'mei–Miyi section. Capacity enhancement of the E'mei–Miyi section would reduce the time to get their agricultural products to markets, thereby improving their economic conditions and contributing to poverty reduction.

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[17] *Sichuan Provincial Government announcement on issuing the 20142015 action plan for energy conservation, emission reduction and low carbon development* (Announcement [2014] No. 70) 《四川省人民政府办公厅关于印发2014—2015年四川省节能减排低碳发展行动方案的通知》(川办发〔2014〕70号)

[18] *Report on the results of assessment of major pollutant emissions in the cities in 2015* (Sichuan Energy Conservation and Emission Reduction Office [2016] No. 5)《关于各市（州）2015年主要污染物总量减排考核结果的通报》川节能减排办〔2016〕5号

[19] *Sichuan Development and Reform Commission on the issue of Interim Method for Carbon Emission Trading in Sichuan*(Announcement [2016] No. 385) 四川省发展和改革委员会关于印发《四川省碳排放权交易管理暂行办法》的通知（川发改环资2016【385】号）

131. Construction for the capacity enhancement of the E'mei–Miyi section would directly employ over 242,000 person-years of unskilled labor from 2016 to 2022. Operation of 18 stations would employ approximately 1,597 people. Construction of the Xichang West Station would employ approximately 100 workers throughout the 2-year construction period. Approximately 356 people would be employed to operate the station.

132. Train speed would be increased from the present 60 km/h to 120 km/h for freight trains and 160 km/h for passenger trains. This would reduce the travel time from Chengdu to Kunming from 22 h to less than 8 h, and would reduce the travel cost by approximately 20%.

133. The number of train passengers per year is expected to reach 1 billion in 2025 and 1.3 billion in 2035. The number of passengers per year at the 18 stations has been estimated to reach 5.88 million in 2025 and 7.54 million in 2035. The annual passenger throughput at the Xichang West Station has been predicted to reach 5.99 million in 2030 and 8.12 million in 2040. Cargo throughput at the stations (inbound plus outbound) has been estimated to be over 65 million t in 2025 and 83 million t in 2035, compared to 28.6 million t in 2012. Increase in the number of passengers and freight tonnage using rail equates to a decrease of passengers and freight using road transport, which would contribute to reductions in air and greenhouse gas emissions from motor vehicles.

B. Impacts Associated with Project Location, Planning and Design

134. **Permanent Land Take**. Construction of the Xichang West Station will take up approximately 40.09 ha of land permanently, composing of 39.89 ha (99.5%) cultivated land and 0.20 ha (0.5%) of rural homestead[20]. Land acquisition would result in the resettlement of 33 households with 132 residents, and demolition of approximately 11,453 m2 of buildings. In view of the size of permanent land take for the station being relatively small and the existing land use being dominated by cultivated land, potential impact on the overall environmental setting and agricultural and biological resources in Xichang City is expected to be minor.

135. **Temporary Land Take**. Facilities such as construction staging areas (including construction camps, asphalt mixing/concrete batching stations and pre-casting yards), borrow areas, spoil disposal sites and haul roads established specifically for the project will take up land temporarily during the construction stage. Station construction would share the construction staging areas, haul roads and some borrow areas with the construction of the railway subgrade and tracks According to the revised EIR, temporary land take that could be attributed to constructing the Xichang West Station would total 32.75 ha for the borrow area and the spoil disposal site. The borrow area would be located approximately 4,000 m left of chainage DK425+500 and the spoil disposal site would be located approximately 1,050 m right of chainage DK427+800. These areas are vacant land defined as dry land[21] in PRC's *Current land use classification* (GB 21010-2007). Both the borrow area and the spoil disposal site will be rehabilitated upon completion of construction except those to be used by other projects. Potential impact is therefore temporary and reversible.

[20] Rural homestead is a term in PRC's *Current land use classification* (GB 21010-2007) for village house for residential use

[21] Dry land is defined in PRC's *Current land use classification* (GB 21010-2007) as land with no irrigation facility but could be used for the cultivation of xerophytic agricultural products using natural precipitation or diverted flood water.

C. Measures during Detailed Design and Pre-Construction

136. **Measures during Detailed Design.** The design institute shall take note of the following measures during detailed design of the stations.

(i) Technical design of the spoil disposal site shall have adequate drainage provisions and mitigation measures described in the revised EIR to prevent soil erosion.
(ii) To minimize the quantities of borrow materials and spoil disposal, the reuse of earth cut materials for backfilling shall be maximized.

137. **Measures during Pre-Construction.** A number of environmental management measures shall be implemented in the pre-construction phase to ensure project's environment management readiness. These include:

(i) The PMO, as the EA/IA, shall complete the following prior to construction commencement:
  a) Establish a project-specific grievance redress mechanism (GRM) including a complaint hotline.
  b) Appoint qualified staff as the environmental coordinator to oversee EMP implementation.
  c) Appoint the project management consultant (PMC). The PMC shall have a loan implementation environmental consultant (LIEC) on the team to undertake the role of third-party environmental monitor during loan implementation. Or the PMO can engage an individual LIEC, who is qualified and has experienced in ADB loan projects.
  d) Include specifications for environmental protection in all civil works tender documents and contracts.
  e) If necessary, update the EMP to reflect changes made (such as road alignment, construction methods, construction site locations, etc.) during the detailed design.
  f) Engage construction supervision companie(s), which shall have an environmental supervision engineer (ESE,环境监理) responsible for the environmental supervision of contractors and environmental audit of construction sites.
  g) Appoint an environmental monitoring station (EMS, 环境监测站) to undertake environmental monitoring according to the EMP during construction and operation of the railway station.

D. Impacts and Mitigation Measures during the Construction Stage

138. **Impact Screening.** Station construction will include site formation, and construction of buildings, station platforms and related ancillary facilities. Potential environmental impacts arising from such activities would include air quality, noise, water quality, ecology, solid waste, soil erosion and occupational health and safety.

139. Potential air quality impacts could occur due to fugitive dust generated on the construction site during earth works, from stockpiles of uncovered earth materials, and vehicles travelling on unpaved haul roads; as well as particulate matters from concrete batching. The use of powered mechanical equipment (PME) during construction activities will generate noise. Potential vibration impact would mainly occur during blasting for tunnel construction and is unlikely to be an issue for station construction. Construction activities will generate process wastewater and construction

workers will produce wastewater. Permanent and temporary land take will result in loss of vegetation and habitats for wildlife and increase the potential for soil erosion. Construction works will produce construction wastes including excavated earth materials. Workers will face occupational health and safety issues working on construction sites such as exposure to respirable particulates and noisy PME. These potential impacts are assessed and addressed below.

1. Impacts and Mitigation Measures on Physical Resources

140. **Air Quality.** Main air pollutants during the construction stage in this project include (i) fugitive emissions of dust during earth works and from uncovered stockpiles and vehicles travelling on unpaved haul roads; and (ii) particulate matters from asphalt mixing during concrete batching[22] and exhaust from movements of construction vehicles and machinery. Based on earth cut and fill quantities provided in the revised EIR, CREEGC estimated that approximately 13.85 t of fugitive dust would be generated during construction of Xichang West Station. The revised EIR estimated that without mitigation, such fugitive dust would impact sensitive receptors located within 150 m downwind from the construction site. Without mitigation, fugitive dust during the construction of Xichang West Station could potentially affect the sensitive receptors listed in Table 18 above.

141. The revised EIR reported monitoring results of particulate matters concentrations ranging from 0.501 to 0.525 mg/m^3 at the boundary of concrete batching stations on a similar railway construction project in Sichuan Province, showing compliance with the *Air pollutant integrated emission standards* (GB 16297-1996). The revised EIR also estimated that the use of fossil fuel by construction machinery would emit air pollutants such as CO, VOC and NO_x. However, such emissions would be relatively small and localized and potential air quality impact would be confined to the immediate vicinity of the machinery. The revised EIR indicated that watering of unpaved areas and covering of open material stockpiles were effective dust suppression measures on construction sites.

142. The Contractor shall include all necessary mitigation measures to reduce air pollution and dust and particulate matters development that would impact public health, by implementing the following air quality control measures. Some of these measures are generic measures that are applicable to all construction sites and construction activities. Yet these are effective measures and are also described in WBG's EHS guidelines.

(i) Site concrete batching station specifically for station construction at least 300 m downwind of the nearest household
(ii) Equip concrete batching plant with fabric filters and/or wet scrubbers to reduce the level of dust emissions.
(iii) Provide personal protective equipment (PPE) such as goggles, gloves and respirators to construction workers where necessary to minimize skin exposure to and inhalation of fumes and dust.
(iv) Spray water at least twice each day on unpaved areas, haul roads and exposed dust-prone stockpiles except on rainy days.
(v) Pave frequently travelled haul roads and construction site and construction staging area exits with gravel or asphalt.
(vi) Control vehicle speed to $\leqslant$ 8 km/h in unpaved areas including unpaved haul roads.

[22] Station construction contractors most likely would share the use of concrete batching stations already set up for the construction of the rail line and might not set up concrete batching plants specifically for station construction.

Post the speed limit sign in these areas.

(vii) Install wheel washing equipment or conduct wheel washing manually at each exit of the works area and concrete batching station to prevent trucks from carrying muddy or dusty substance onto public roads.

(viii) Store dust-prone materials in areas with shelters on four sides and on top. If such materials have to be stored in open area, cover with strong tarpaulin.

(ix) Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin.

(x) Regularly maintain construction vehicles and machinery to minimize exhaust emissions from these sources.

(xi) Unauthorized burning of construction and demolition waste material and refuse shall be subject to penalties for the Contractor, and withholding of payment.

143. These measures are defined in the EMP. Contractors will be required to ensure compliance with relevant PRC emission standards. Air quality monitoring will be carried out by a licensed environmental monitoring entity (external) during the construction period. Potential air quality impacts during the construction stage would be of short duration and localized. With the above mitigation measures in place, potential air quality impacts during the construction stage would be reduced to acceptable levels.

144. **Noise**. Noise is emitted by PME used during construction. The revised EIR indicated that the noise levels for PME used for site formation and building construction would range from 75 dB(A) to 130 dB(A) per piece of machinery, based on sound power levels provided in *Technical guidelines for environmental noise and Vibration Control Engineering* (HJ 2034-2013) and onsite measurements at the noise sources. The use of combinations of different types of PMEs would certainly result in generating higher noise levels during construction. In the PRC, construction noise levels are controlled at the boundary of the construction site. The *Emission standard of environmental noise for boundary of construction site* (GB 12523-2011) specifies that construction noise at the boundary of construction site should not exceed 70 dB(A) in the day time and 55 dB(A) at night (from 22:00 to 06:00 hours). The revised EIR have identified effective mitigation measures including the siting of noisy construction activities and equipment such as concrete batching, air compressors and generators away from populated areas, the use of enclosures and temporary noise barriers, and sensible scheduling of noisy activities (such as no night time construction) and equipment deployment.

145. Contractors shall be required to implement the following mitigation measures for construction activities to meet PRC construction site and WBG recommended noise limits and to protect sensitive receptors. Some measures are generic and are applicable to all construction sites and activities. Yet they are effective measures and are also in line with WBG's EHS guidelines.

(i) During daytime construction, the contractor shall:

a) properly maintain machinery to minimize noise;

b) deploy low noise machinery or the equipment with sound insulation when working within 100 m from villages or townships;

c) site concrete batching station specifically for station construction at least 300 m away and downwind (for air quality purpose) from the nearest sensitive receptor; and

d) erect temporary noise barriers or hoardings around the equipment to shield

the noise from equipment when there are residences, schools, health clinics or mosques within 50 m of the noise source.

(ii) There will be no night time (between 22:00 and 06:00 hours) construction.
(iii) Provide the construction workers with suitable hearing protection (ear muffs).
(iv) Ensure regular equipment repair and maintenance to keep them in good working condition.
(v) Forbid the use of horns unless absolutely necessary, minimize the use of whistles.

146. The World Bank Group's EHS guideline also provides the following guidance to mitigate noise and vibration impacts caused by the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people during construction and decommissioning activities:

(i) Plan activities in consultation with local communities so that activities with the greatest potential to generate noise and vibration are planned during periods of the day that will result in least disturbance.
(ii) Use noise control devices, such as temporary noise barriers and deflectors for impact and blasting activities, and exhaust muffling devices for combustion engines.
(iii) Avoid or minimize project transport through community areas.

147. Noise impacts during construction would be of short duration. Potential sensitive receptors will be exposed to short term, temporary and localized impacts. With the above mitigation measures in place, potential noise impacts during construction would be reduced to acceptable levels.

148. **Water Quality.** Uncontrolled wastewater and muddy runoff from construction sites, work camps and particularly concrete batching stations could potentially pollute nearby water bodies and clog up drains. The revised EIR estimated that each construction worker would generate approximately 60 L/d of wastewater. The EA estimated an average of approximately 100 construction workers would be working on the construction of Xichang West Station daily. Wastewater generated by construction workers would amount to only 6 m^3/d, which will be treated with septic tanks then discharged into nearby irrigation ditches. The revised EIR estimated that the septic tank effluent would contain 113 mg/L COD, 37 mg/L BOD_5 and 63 mg/L SS, based on monitoring of septic tank effluent in other similar railway projects, which would comply with the *Standards for irrigation water quality* (GB 5084-2005).

149. Process wastewater generated during concrete batching and on construction site was estimated to be approximately 20 m^3/d. The main pollutant would be SS, which would go through sedimentation in sedimentation tanks installed at the concrete batching station and on construction site. After sedimentation, the supernatant is usually used for dust suppression within the concrete batching station and on construction site. The revised EIR presented monitoring results of water quality after sedimentation from concrete batching stations in similar railway projects, showing highest concentration levels of 62.4 mg/L for COD, 0.31 mg/L for TPH, and 25 mg/L for SS. These concentration levels complied with the Class I standard in *Integrated wastewater discharge standard* (GB 89781-996) for discharging into Category 3 water bodies. The nearest water body is the Anning River located approximately 1.5 km from the Xichang West Station site. It is unlikely that the small quantity of treated wastewater generated daily on the construction site would adversely affect the water quality of Anning River.

150. The contractors shall implement the following mitigation measures to prevent water pollution:

(i) Provide portable toilets and small package wastewater treatment plants and/or septic tanks on construction sites and construction camps for the workers. If there are nearby public sewers, install interim storage tanks and pipelines to convey wastewater to public sewers. Collect and treat site runoff from construction sites and construction camps with drainage provisions.

(ii) Install and operate sedimentation tanks on construction sites and concrete batching station to treat process water (e.g. concrete batching) and muddy runoff with high concentrations of suspended solids. If necessary, use flocculants such as polyacryl amide (PAM) to facilitate sedimentation.

(iii) Site storage and refueling facilities for fuels, oil, and other hazardous materials within secured areas on impermeable surfaces at least 300 m away from water bodies, and provided with bunds and cleanup kits. If refueling in the field is required, it shall be done from road-licensed fuel trucks away from watercourses or other environmentally sensitive areas.

(iv) Protect material stockpiles against wind and runoff water which might transport them to surface waters. There shall be no storage of materials and equipment in or close to water bodies.

(v) Clean up any chemical spills into drains and water bodies within 24 hours of the occurrence, with contaminated soils and water treated according to *Technical guidelines for site soil remediation* (HJ 25.4-2014). Records must be handed over without delay to the PMO and local EPB.

151. With the above measures in place, potential water quality impact should be mitigated to acceptable levels.

152. **Solid Waste**. Solid waste generated during construction includes refuse generated by construction workers on construction sites and construction and demolition (C&D) waste consisting of excavated spoil from earth works during site formation and waste from demolished buildings. Refuse, or municipal solid waste (MSW) generated by each construction worker has been estimated by the revised EIR to be approximately 0.25 kg/d, or 0.09 t/a. Based on an estimated daily average of 100 construction workers by the EA, MSW generated by the construction workers would average 25 kg/d or 9 t/a. Garbage bins will be provided on construction sites for the collection of MSW generated by construction workers. The collected refuse will be regularly removed by local sanitation bureaus for disposal at local landfills.

153. To make way for station construction, existing buildings on the station sites would have to be demolished. The waste generated from building demolition at the Xichang West Station site has been estimated to total approximately 11,164 t. According to the revised EIR, this waste would be transported to designated C&D waste treatment centers or other locations designated by local authorities for treatment and disposal.

154. Earth cut and fill balance for the construction of Xichang West Station is shown in Table 21. Of the nearly 900,000 m^3 of earth cut, only 0.08% will be re-used and nearly all will be disposed of at the spoil disposal site. Approximately 2.57 million m^3 of earth fill material will be needed and basically nearly all will be imported from the borrow area.

Table 21: Earth cut and fill balance for construction of Xichang West Station

Earth Cut	Earth Fill	Reuse		Import from Borrow Area	Purchase	Disposal
		On-site Material	From Tunneling			
892,452 m^3	2,569,925 m^3	767 m^3	0 m^3	2,569,158 m^3	0 m^3	891,685 m^3

Source: CREEGC.

155. The contractors shall implement the following mitigation measures to manage construction waste and MSW generated during construction. With these measures in place, solid waste generated during construction should have minimal environmental impact.

(i) Maximize the re-use of construction waste on the project.
(ii) Site borrow area and spoil disposal site for station construction at least 300 m from residential areas so as to reduce potential dust and noise impacts from these sites.
(iii) Include all soil erosion prevention measures listed in the approved revised EIR in the design of borrow area and spoil disposal site.
(iv) Rehabilitate and vegetate spent borrow area and spoil disposal site within one month after closure to prevent soil erosion and dust generation.
(v) Store all MSW and construction waste generated on construction sites in designated areas and remove them from these locations for disposal or reuse regularly.

156. **Soil Erosion**. Runoff from construction sites is one of the largest sources of sediment in urban areas under development. If uncontrolled, eroded sediment from construction sites creates adverse impacts on water quality, drainage and recreational activities. Soil erosion prevention would include the implementation of engineering measures, planting measures and temporary measures during station construction. Implementation of these measures would reduce soil erosion due to the project by about 97.8%. The contractors shall:

(i) Install and implement soil erosion prevention measures in all construction sites, construction staging areas, borrow areas and spoil disposal sites in accordance with requirements in the approved revised EIR.
(ii) Pay close attention to drainage provision and establishment of vegetation cover on backfilled areas to prevent soil erosion.
(iii) If restoration is carried out during periods of hot or extreme weather, ensure adequate aftercare to maximize survival of vegetation.

2. Impacts and Mitigation on Biological Resources, Ecology and Biodiversity

157. The Xichang West Station site would permanently take up approximately 40.09 ha of land dominated by cultivated land (99.5%). This accounts for 0.18% of the ecological assessment area of the capacity enhancement of the E'mei–Miyi section (see Table 11) and 0.35% of the cultivated land within the ecological assessment area. Temporary land take for borrow area and spoil disposal site would be approximately 32.75 ha that is predominantly vacant dry land, and is approximately 0.15% of the ecological assessment area (see Table 11).

158. The revised EIR indicates the absence of protected species, old trees, critical and natural habitats within the station site and temporary land take area. The revised EIR also concluded, as stated in the section on associated facilities, project design for the capacity enhancement of the E'mei–Miyi section (including the stations) had already adopted the avoidance principle towards Giant Panda habitats, nature reserve and scenic areas, and that based on the scale of impact on

vegetation in relation to the scale within the ecological assessment area, such impact would not drastically alter the germplasm resource, the floral composition and the agricultural production structure within the ecological assessment area.

159. The contractors shall implement the following mitigation measures during construction for protection of biological resources.

(i) Construction workers are prohibited from capturing any wildlife during construction.
(ii) Protect existing trees and grassland during construction; remove trees or shrubs only as the last resort if they impinge directly on the permanent works or necessary temporary works.
(iii) Where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area after construction.

3. Impacts and Mitigation on Socioeconomic Resources

160. **Land Acquisition and Resettlement**. Based on the revised EIR and information provided by CREEGC, construction of the Xichang West Station would take up approximately 40.09 ha of land, of which 0.7 ha is rural homestead requiring the demolition of approximately 10,507 m^2 of buildings. No information on resettlement due to station construction is available at present. Land acquisition and resettlement will be in accordance with PRC and ADB policies.

161. **Physical Cultural Resources.** Assessment undertaken did not reveal the presence of physical cultural resources within the footprint of the Xichang West Station. Should buried artifacts of archaeological significance be uncovered during the construction stage within the project areas, construction will be stopped and the discovery will be immediately reported to the local cultural bureaus in accordance with PRC's *Cultural Relics Protection Law* (2002) and the *Cultural Relics Protection Law Implementation Ordinance* (2003).

162. **Occupational Health and Safety.** Due to its nature the construction industry is considered to be one of the most hazardous industries where a number of potentially hazardous operations are carried out. The contractors shall implement the following measures and precautions to protect the health and safety of construction workers.

(i) Environment, health and safety officer: Each contractor shall appoint at least one environment, health and safety (EHS) officer to manage occupational health and safety risks on construction sites by applying the following measures.
(ii) Construction site sanitation: (a) Each contractor shall provide adequate and functional systems for sanitary conditions, toilet facilities, waste management with waste separation, labor dormitories and cooking facilities; (b) Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse bins and ensure timely removal of solid waste; (c) Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year; (d) Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas, if any, on construction site, and appoint designated staff responsible for cleaning and disinfection; (e) Construction site domestic wastewater shall be discharged into the municipal sewer system or treated on-site using a portable system.
(iii) Occupational safety: (a) Provide personal protective equipment (safety hats and

shoes, high visibility vests, and safety belt and harness for above ground works) to all construction workers and strictly enforce all workers to put on the PPE; (b) Provide safety goggles, gloves and respiratory masks to workers doing interior fit-out works; (c) Provide ear plugs to workers operating and working near noisy PME.

(iv) Food safety: (a) Inspect and supervise food hygiene in canteens, if any, on site regularly. Canteen workers must have valid health permits; (b) If food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.

(v) Disease prevention, health services: The following disease prevention measures and health services shall be undertaken: (a) Construction workers must have physical examination before start working on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the second year onwards, conduct physical examination on 20% of the workers every year; (b) Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents; (c) Provide induction and training by local health departments on prevention and management of communicable diseases.

(vi) Social conflict prevention: No major social risks and/or vulnerabilities are anticipated as a result of the project. The project construction workers will be engaged locally. Civil works contracts will stipulate priorities to (a) employ local people for works, (b) ensure equal opportunities for women and men, (c) pay equal wages for work of equal value, and to pay women's wages directly to them; and (d) not employ child or forced labor.

163. **Community Health and Safety.** Temporary traffic diversions, continual generation of noise and dust on haulage routes, and general hindrance to local access and services are common impacts associated with construction works within or nearby local settlements. The potential impacts on community health and safety will be mitigated through a number of activities defined in the EMP. The contractors shall implement the following measures:

(i) Traffic management: A traffic control and operation plan shall be prepared together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.

(ii) Information disclosure: (a) Construction billboards, which include construction description, schedule, responsible person and complaint phone number, shall be erected at the entry to each construction site and construction staging area. (b) Residents and businesses shall be informed in advance of noisy construction activities such as piling, given the dates and duration of expected disruption and made aware of the project GRM.(c) Clear signs shall be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc. and raising awareness on safety issues.

(iii) Construction sites: All sites shall be made secure, discouraging access by members of the public through appropriate fencing, signage and/or security personnel, as appropriate.

164. **Utilities Provision Interruption.** Construction may require relocation of municipal utilities such as power, water, communication cables. Temporary suspension of services (planned or accidental) can affect the economy, industries, businesses and residents' daily life. Mitigation of impacts on utilities provision will be through a number of activities defined in the EMP, to be incorporated in the tender documents and construction contracts:

(i) Contractors shall assess construction locations in advance and identify potential for disruption to services and risks before starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities is subject to full compensation, at the full liability of the contractor who caused the problem.
(ii) If temporary disruption is unavoidable the contractor shall, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to affected persons.

E. Impacts and Mitigation Measures during the Operational Stage

165. **Impact Screening**. The capacity enhanced rail line for the E'mei–Miyi section will use electric powered trains. The station buildings will use air conditioners for cooling and heating and there will not be any coal burning boiler for heating. Therefore, air quality and greenhouse gas emissions are not environmental issues during operation of the rail line and the station. It is estimated that the Xichang West Station would have approximately 15,000 m^2 of building area, with approximately 356 employees added and a passenger throughput of 5.99 million per year in the near term (year 2030) and 8.12 million per year in the long term (year 2040). These individuals would produce domestic wastewater and municipal solid waste (MSW) at the stations that would require collection, treatment and disposal. Trains arriving and leaving the stations would generate noise and vibration that could potentially affect nearby sensitive receptors. Electric power substation would be constructed which would have potential electromagnetic radiation impact to nearby sensitive receptors.

1. Impacts and Mitigation on Noise and Vibration

166. Operational noise assessment in the revised EIR was based on train noise, including train noise at the station. Table 22 shows noise predictions and the corresponding mitigation measures for the near term (year 2025) at the sensitive receptors near the Xichang West Station. Assessment results show that day time and night time noise levels at both locations would exceed the noise standard of 60 dB(A) during day time and 50 dB(A) during night time for category 2 noise functional area. Mitigation measures would include the installation of double-glazed windows at both locations as well as the erection of noise barriers at the chainages specified in Table 22 for Zhongxin Village / Xinfu Village and vicinity.

Table 22: Near term (year 2025) operational noise assessment and mitigation for sensitive receptors near the Xichang West Station

No.	Noise Sensitive Receptor	Chainage	Noise Level [dB(A)]		Noise Functional Area Category	Mitigation Measure
			Day Time	Night Time		
1	Taihe Village and vicinity	DK430+650 to DK431+800	62.5	61.3	2	Install double-glazed windows totaling 380 m^2.
2	Zhongxin Village / Xinfu Village and vicinity	DK432+750 to DK434+150	63.8	62.4	2	Install double-glazed windows totaling 350 m2. Erect noise barrier at DK433+920 to DK434+120 (right) and at DK434+000 to DK434+200 (left)
Note: GB 3096–2008 Standard for noise functional area category 2: 60 dB(A) day time and 50 dB(A) night time						

Source: Revised EIR.

167. The revised EIR indicated that potential vibration impact during operation would mainly affect buildings above six tunnel locations and its assessment showed compliance with PRC's *Standard of environmental vibration in urban area* (GB 10070-88) at these locations. No sensitive receptor in the vicinity of the Xichang West Station would be exposed to potential vibration impact during station operation.

2. Impacts and Mitigation on Electromagnetic Radiation

168. The revised EIR estimated that the magnetic induction strength at the boundary wall of the traction substation would be slightly greater than 0.2 μT, decreasing to less than 0.1μT at a distance of 20 m from the boundary wall. This is substantially less than the recommended limit of 0.1 mT at a distance of 50 m away prescribed in *Technical guidelines for environmental impact assessment of electric power transmission and distribution project* (HJ 24–2014). The electric field strength just outside the traction substation boundary wall was estimated to be less than 300 V/m, decreasing to approximately 200 V/m at a distance of 20 m from the boundary wall. This is also substantially less that the 4 kV/m limit at a distance of 50 m away prescribed in HJ 24–2014. No electromagnetic radiation impact would be anticipated.

3. Impacts and Mitigation on Water Quality

169. Based on the number of staff and passengers at the Xichang West Station, the revised EIR estimated that approximately 205 m^3/d of wastewater would be generated during its operation. The revised EIR proposed using sequential batch reactor (SBR) for treatment of wastewater generated from the Xichang West Station during operation, for discharging into nearby drainage ditch leading to the Anning River which is a category 3 water body located approximately 1.5 km from the station. Table 23 shows the influent wastewater quality and the effluent quality after SBR treatment, indicating compliance with Class I standard of GB 8978-1996 (see Table 6) for discharging into category 3 water bodies. Wastewater from station operation would have minimal surface water quality impact.

Table 23: Xichang West Station wastewater influent and effluent quality

Data Source	Water Quality Parameter Concentration				
	pH	SS (mg/L)	BOD_5 (mg/L)	COD (mg/L)	NH_3–N (mg/L)
Station wastewater influent quality based on monitoring data for acceptance inspection of the Chongqin – Huaihua Rail Line	7.59 – 7.65	358	76.9	295	20.2
Monitoring data on effluent quality from SBR treatment for acceptance inspection of the Xindaying Railway Station	7.58	28.6	17.9	69.9	13.0
GB 8978-1996 Class I standard:	6 - 9	70	20	100	15

Source: Revised EIR.

4. Impacts and Mitigation on Solid Waste

170. The revised EIR estimated that the quantities of municipal solid waste (MSW) generated by the station workers (51.83 t/a) and passengers (142.50 t/a) at the Xichang West Station during operation would total approximately 194.33 t/a (or 0.53 t/d) in the near term. The station would be equipped with MSW collection and storage facilities. MSW at the station would be regularly collected by the local sanitation bureau for disposal at the local sanitary landfill.

F. Cumulative Impacts

171. Cumulative impacts could arise from other projects in the vicinity being constructed concurrently with the construction stage of this project. Construction of the station would take approximately 24 months and would occur concurrently with the construction of the E'mei–Miyi rail tracks during the later part of the 6.5-year construction period for the capacity enhancement of the E'mei–Miyi section. Cumulative environmental impacts from station and track construction have been considered in the revised EIR, which assessed construction impacts for the capacity enhancement of the E'mei–Miyi section as a whole and concluded that potential environmental impacts would be acceptable with implementation of mitigation measures as described in the section on associated facilities. At this time no information is available on potential construction works from other projects that could overlap with the construction stage of this project.

172. Construction related cumulative impacts will be effectively minimized by adopting proper mitigation measures, including: (i) coordination between all project components and other projects in the area of influence in terms of construction schedule, possible access road and borrow/disposal sites and spoil sharing; (ii) contractors will develop material transport plan with consultation of local road management authority and local community; (iii) enforcement of good construction management to minimize dust, noise and waste generation; (iv) education of construction workers to minimize social disturbance and cultural conflict; (vi) provision of temporary access to local traffic; (vii) proper maintenance of the access roads and timely restoration/strengthening upon completion. With effective implementation of good construction management measures, these common construction-related cumulative impacts can be adequately mitigated to acceptable levels.

G. Indirect and Induced Impacts

173. Approximately 100 workers on average would be employed throughout the 2-year construction period of the Xichang West Station, and 356 staff would be employed for operating the station.

174. Rural households would increase and diversify agricultural production to increased market-oriented agriculture because of expanded access to markets and the ability to move bulk goods, and their quality of life would improve due to improved access to goods, services and social infrastructure at reduced costs. Travel time would be substantially reduced to tourist destinations. It has been estimated that over 8,000 in 2025 and 12,000 in 2042 tourism-related jobs would be generated along the E'mei–Miyi section of the Chengkun Rail Line. The current tourism revenue of CNY 78.5 billion is expected to nearly double to about CNY 150 billion once the rail line begins operation resulting in improved connectivity and reduced travel time and cost.

VI. ANALYSIS OF ALTERNATIVES

A. No Project Alternative

175. The project, which is an integral part with the capacity enhancement of the E'mei–Miyi section, would reduce travel distance, time and cost. Without the project, it would take 18–22 hours to travel from Chengdu to Kunming instead of less than 8 hours, and about 20% more expensive in cost.

176. Without the capacity enhancement of the E'mei–Miyi section, it would take longer for the agricultural products to get to the markets. This would affect the livelihood and hinder economic development and poverty alleviation of the ethnic minority groups in the area who are agriculture and livestock dependent. Without the capacity enhancement of the E'mei–Miyi section, inefficient railway network connection between the western and northwestern PRC with the GMS would persist. This would slow down the wider perspective of regional and national socio-economic development.

177. The Xichang West Station is a key multimodal passenger hub on the E'mei–Miyi section, particularly beneficial to the tourists visiting the popular Qionghai in Xichang City. Without the station, the tourism industry in Xichang City and in the Liangshan Yi Autonomous Prefecture would be adversely affected.

B. Alternatives Considered

178. The avoidance principle was adopted, resulting in selected options that are further away from environmentally sensitive areas, with less geological and engineering risks as well as less house demolition and resettlement. Two locations for the Xichang West Station were considered. One in Xixiang Village and the other in Taihe Town. The one in Taihe Town was selected as it complies with the area identified in the Liangshan Yi Autonomous Prefecture urban and rural development plan for the station.

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Legislative Framework for Consultation, Participation and Information Disclosure

179. Meaningful participation and consultation during project planning, feasibility study, design and implementation is an important environment safeguards requirement. It can directly reflect the public's perceptions of environmental quality in the project's area of influence. Public participation and environmental information disclosure provisions are among the most significant changes introduced in the amended *Environmental Protection Law* (2014). The legislative framework also includes decrees on the preparation of EIA summaries for the purpose of public disclosure (see Table 1, item 36), information disclosure on construction project EIAs by

government (Table 1, item 40), measures for public participation in environmental protection (Table 1, item 41), and technical guidelines (for comment) for public participation in EIAs (Table 1, item #73).

180. ADB Safeguard Policy Statement (2009) requires meaningful participation, consultation and information disclosure. ADB Public Communications Policy: Disclosure and Exchange of Information (2011) requires that the borrower shall provide safeguard information to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them.

B. Consultation and Participation during Project Preparation

181. In addition to the consultation and participation described in section III.G above (Associated Facilities) for the capacity enhancement of the E'mei–Miyi section, a questionnaire survey and a discussion forum were conducted specifically for the Xichang West Station and the railway section pertaining to the station.

182. Table 24 summarizes the information collected from 52 questionnaire surveys. All would support the project and deemed the major benefit to be the promotion of economic development. Other benefits of the project included development of tourism, trip convenience and better traffic conditions. About 45% indicated their understanding on potential environmental impacts of the project and the other 55% indicated their understanding but emphasized on the need to adopt mitigation measures. Noise and vibration followed by electromagnetic interference were deemed to be the major environmental impacts during construction and operation (although there should not be any electromagnetic interference during construction and should not be included as a potential impact during construction). In terms of mitigation, the majority would like to be relocated, and that double-glazed windows were less popular than noise barriers.

Table 24: Xichang City questionnaire survey on the Xichang West Station section of the rail line

No.	Question	Opinion	% Response
1	What is your view on the major meaning of this project?	Promote economic development	100
		Speed up tourism development	68.6
		Improve trip convenience	74.5
		Increase employment opportunities	41.2
		Improve traffic conditions	78.4
		Others	0
2	What is your view on the major environmental impacts during construction?	Land take and acquisition	43.1
		Destruction of vegetation	29
		Visual and landscape impact	4
		Noise and vibration impact	7.8
		Ground water impact	62.8
		Water body pollution	15.7
		Dust pollution	17.7
		Traffic impact	0
		Electromagnetic interference	47.1
		Others	2.0
3	What is your view on the major environmental impacts during operation?	Noise	88.2
		Vibration	35.3
		Wastewater	31.4
		Electromagnetic interference	51.0
		Refuse from the station	17.7
		Others	2.0

No.	Question	Opinion	% Response
4	What is your attitude on potential impacts caused by the project?	Could understand	45.1
		Could understand but must adopt mitigation measures	54.9
		No comment	0
5	What mitigation would you expect for noise and vibration impacts?	Functional replacement of houses	25.5
		Resettlement / relocation	60.8
		Installation of noise barrier	51.0
		Installation of double-glazed window	23.5
		Others	13.7
6	What is your attitude on this project?	Support	100.0
		Do not support	0

Source: Revised EIR.

183. A discussion forum was conducted on 23 June 2014 in Xixiang Village in Xichang City. It was attended by representatives from various villages in the city, city government representatives, and representatives from the IA and the EIA institute (Figure 14). The project was supported by the village representatives. Views and comments included: (i) site selection to avoid heavily populated areas and to minimize local residents' land and property losses; (ii) land acquisition and resettlement should strictly comply with applicable policies, laws and regulations; and (iii) noise mitigation measures should be adopted along the railway line for affected households.

C. Future Plans for Public Participation

184. Meaningful consultation to safeguard the environment and local residents will continue before and throughout construction and operation phases consisting of information disclosure on project proponent and relevant government department web sites, posting of project information on community notice boards and discussion forums. The PMO and the IA will be responsible for organizing the public consultations, with the support of the LIEC on the project management consultant (PMC) team. The contractors will be required to communicate and consult with the communities in the project area of influence, especially those near the stations. Clearly visible public notice boards will be set at each work site to provide information on the purpose of the project activity, the duration of disturbance, the responsible entities on-site (contractors, IA), and the project level Grievance Redress Mechanism (GRM). Contact information of all GRM entry points and the PMO complaint center hotline will be disclosed on the construction site information boards. Consultation will focus on public nuisances from construction and operation activities, such as noise, dust, traffic disturbance, as well as public concerns about the environment and resettlement.

185. Future consultation and participation will also include (i) involvement of affected people in discussion forums during inspection and monitoring of EMP implementation during construction and operation phases; (ii) participatory evaluation on the environmental and social-economic benefits and impacts in these forums; and (iii) consultation with the public after the project completion. The EMP provides plans for future public participation. The EMP for this project is included in Appendix 1 of this report.

Figure 14. Discussion forum in Xixiang Village in Xichang City on 23 June 2014

VIII. GRIEVANCE REDRESS MECHANISM

186. Public participation, consultation and information disclosure undertaken as part of the domestic EIR process, assessment and development of resettlement plans, and consultations undertaken by the project consultants have discussed and addressed major community concerns. Continued public participation and consultation have been emphasized as a key component of successful project implementation. As a result of this public participation and safeguard assessment during the initial stages of the project, major issues of grievance are not expected. However, unforeseen issues may occur. To settle such issues effectively, a transparent grievance redress mechanism (GRM) for lodging complaints and grievances has been defined for environment related issues.

187. The GRM has been designed to help achieve the following objectives: (i) open channel for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) prevent and mitigate any adverse environmental impacts on communities caused by project construction and operations; (iii) improve mutual trust and respect and promote productive relationships with local communities; and (iv) build community acceptance of the project.

188. The PMO will establish a complaints center with a hotline for receiving both environmental and resettlement grievances. The details of the GRM are described in the EMP (Appendix 1), and

were also explained to various stakeholders during meetings and consultations. The GRM will be operational prior to commencement of construction works.

189. In addition to the project GRM, ADB's overall accountability mechanism (2012) applies.[23] This mechanism provides opportunities for people adversely affected by ADB-financed projects to express their grievances; seek solutions; and report alleged violations of ADB's operational policies and procedures, including safeguard policies. ADB's accountability mechanism comprises two separate, but related, functions: (i) consultation, led by ADB's special project facilitator, to assist people adversely affected by ADB-assisted projects in finding solutions to their problems; and (ii) providing a process through which those affected by projects can file requests for compliance review by ADB's Compliance Review Panel.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives

190. An environmental management plan (EMP) has been prepared for the project. It will provide the mechanism to implement mitigation measures and monitoring programs. The full EMP is presented in Appendix 1. It will also be included as an Appendix to the Project Administration Manual (PAM) for the project. The EMP defines mitigation measures and describes the involved institutions and mechanisms to monitor and ensure compliance with environmental regulations and implementation of the mitigation measures. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the project in order to prevent, reduce, or mitigate adverse impacts. The EMP draws on the domestic revised EIR, this project IEE, and the PPTA discussions and agreements with the relevant government agencies, at the same time making reference to the soil and water conservation measures on soil erosion. The plan to mitigate and monitor soil erosion during construction is comprehensive and very lengthy so is not included in the EMP. The EMP will be reviewed and updated at the end of the detailed design in order to be consistent with the final detailed design, and will further be revised during implementation if determined that measures need to be amended or new measures are needed. The updated EMP will be disclosed on ADB's project website.

B. Organizational Structure for Environmental Management

191. As the **executing agency** (EA), CRC will be responsible for the overall implementation and compliance with loan assurances and the EMP. The CKRC will be the **implementing agency** (IA) responsible for arranging the construction of the railway station, construction supervision and quality control. The IA has established the PMO, who will be responsible, on behalf of the EA/IA, for the day-to-day management of the project. The PMO will have the overall responsibility to supervise the implementation of environment mitigation and monitoring measures, coordinate the project GRM and report to ADB. PMO will (i) appoint at least one environmental coordinator on its staff to coordinate and manage EMP implementation, (ii) engage the project management consultant (PMC) services, and (iii) either as a part of PMC, or invidiual selection, engage a loan implementation environment consultant to support PMO's environmental coordinator to ensure effective implementation of EMP, EMoP, GRM, and environmental reporting requirements. PMO will ensure that the environmental specification clauses listed in the EMP are incorporated into all bidding documents for railway station construction. The PMO environmental coordinator, with support from a LIEC will (i) supervise contractors and their compliance with the EMP; (ii) conduct

[23] The revised accountability mechanism became effective on 24 May 2012.

regular site inspections; (iii) act as local entry point for the project GRM; and (iv) submit environmental monitoring results provided by the IA to the PMO for verification. PMO will prepare quarterly project progress reports and annual environment monitoring reports (EMR) and submit them to ADB.

192. To ensure that the contractors comply with the EMP provisions, the IA will ensure that the environmental specification clauses listed in the EMP are incorporated into all civil works bidding documents and contracts for the stations. The IA will (i) contract the local Environmental Monitoring Station (EMS) to conduct environmental quality monitoring during the construction stage, and (ii) contract an external Environmental Supervision Engineer (ESE) as a part of construction supervision companie(s) to conduct independent verification of EMP implementation and environmental monitoring results during the station construction stage. The IA will also communicate closely with local Environmental Protection Bureaus (EPB) for environmental mitigations and domestic environmental compliance issues.

193. Terms of reference for a LIEC are provided in the Project Administration Manual as follows:

(i) assess the project's environmental readiness prior to implementation based on the readiness indicators defined in the EMP;
(ii) support PMO in updating the EMP including environmental monitoring plan as necessary to revise or incorporate additional environmental mitigation and monitoring measures, budget and institutional arrangements, that may be required based on the detailed design; submit to ADB for approval and disclosure; ensure compliance with the PRC's environmental laws and regulations, ADB's Safeguard Policy Statement (2009) and Public Communications Policy (2011);
(iii) if required, update the IEE and EMP reports for changes in the project during detailed design or project implementation (for example if there is a minor or major scope change) that would result in adverse environmental impacts not within the scope of the approved IEE/EMP;
(iv) assist PMO to establish a GRM;
(v) conduct regular EMP compliance assessments, undertake site visits as required, identify any environment-related implementation issues, and propose and oversee implementation of necessary corrective actions;
(vi) assist PMO to prepare quarterly project progress reports and annual EMRs for ADB;
(vii) provide training to PMO, IA and contractors on environmental laws, regulations and policies, SPS 2009, EMP implementation, and GRM in accordance with the training plan defined in the EMP; and
(viii) assist PMO and IA in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities and GRM.

194. The IA will contract an **Environmental Supervision Engineer** (ESE) as a part of CSC to verify environmental performance of contractors during construction and whether the EMP items are effectively and proactively implemented. The ESE will review EMP implementation, monitoring activities and results, assess EMP implementation performance, visit the project sites and consult potentially affected people, discuss assessment with the PMO and the IA; and suggest corrective actions. The ESE will prepare monthly reports for submission to the IA which will be submitted to and reviewed by PMO during the preparation of the quarterly project progress reports for ADB and by the LIEC during the preparation of the annual EMRs for ADB.

195. Construction **contractors** will be responsible for implementing the mitigation measures during construction under the supervision of the IAs (through the ESE) and PMO. In their bids, contractors will be required to respond to the environmental specifications in the bidding documents. Each contractor will be required to assign a person responsible for environment, health and safety.

196. The Chengdu Railway Bureau (CRB) will be the **operation and maintenance (O&M) unit** for the station and associated facilities.

C. Inspection, Monitoring and Reporting

197. **EMP Environmental Monitoring**[24] will include monitoring of air quality, noise, water quality and other parameters described in the EMP during project construction and operation. These will be conducted by the local Environmental Monitoring Stations (EMS) contracted by the IA. The monitoring results will be submitted to the IA and PMO, and will be reported in the quarterly project progress reports and the annual EMRs prepared by the PMO and submitted to ADB.

198. **EMP inspection and monitoring.** Independent evaluation of EMP implementation will be undertaken by the PMO environmental coordinator with support of LIEC. The result of the EMP implementation assessment and EMP enivornmental monitoring results will be recorded and reported to ADB through annual environmental monitoring reports and environmental section of quarterly project progress reports. Annual EMR shall also include information on project implementation, environmental performance of the contractors, environmental compliance on relevant loan covenants, . confirmation on the project's compliance with the EMP as well as local legislation (including the PRC's EIA requirements), any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. Operation and performance of the project GRM, environmental institutional strengthening and training, and compliance with all covenants under the project will be included in the EMR.

199. Within 3 months after project completion, or no later than 1 year with permission of the local EPBs, environmental acceptance monitoring and audit reports for the railway stations shall be: (i) prepared in accordance with the *Management measures for inspection and acceptance of environmental protection at construction project completion* (MEP Decree [2001] No. 13 and 2010 Amendment) (see Table 1, item 26) and *Management procedures for the supervision, inspection and environmental acceptance of construction projects under the "Three Simultaneities"* (on trial) (MEP Announcement [2009] No. 150) (see Table 1, item 31), and *Construction Project Environmental Protection Management Ordinance of the PRC*, 1998 (amended 2017) (see Table 1, item 17); (ii) reviewed for approval by environmental authorities prior to the official commencement of component operation, and (iii) finally reported to ADB. The environmental acceptance reports for completed stations will indicate the timing, extent, effectiveness of completed mitigation and of maintenance, and the needs for additional mitigation measures and monitoring during operation. These environmental acceptance reports will be provided to the LIEC who is responsible for preparing an environmental completion report and inputs for the Project Completion Report (PCR) for ADB.

[24] In this report, "environmental monitoring" refers to the activity of collecting environmental data either through *in-situ* measurements or through sampling followed by laboratory testing of samples.

X. CONCLUSION AND RECOMMENDATION

A. Expected Project Benefits

200. The proposed project is an integral part of the capacity enhancement of the E'mei–Miyi section of the Chengkun Rail Line connecting the northwestern region of the PRC with the GMS via the provinces of Sichuan and Yunnan, promoting socio-economic development in these areas through efficient, cost effective and environmentally friendly rail transport. Travel time between Chengdu and Kunming would be reduced from the present 18–22 hours to less than 8 hours, and travel cost would be reduced by about 20%. This will facilitate more travelers by train, estimated to reach 1 billion/y in 2015 and 1.3 billion/y in 2035. By increasing the capacities for passenger and freight transport by rail, passengers and freight transport by roads would be reduced thereby reducing air and carbon emissions from motor vehicles.

201. The areas along the E'mei–Miyi section are among the poorest areas in Sichuan Province, with populations dominated by ethnic minority groups whose livelihood are agriculture and livestock dependent. Capacity enhancement of the E'mei–Miyi section would allow cheaper and quicker transport of their agricultural output to markets, thereby facilitating improvements to their economic and social conditions, contributing to poverty alleviation.

202. The Xichang West Station will be a key passenger station along the E'mei–Miyi section of the Chengkun Rail Line. This project will develop the station into a multimodal passenger hub, facilitating smooth and seamless transfer of train passengers to other modes of transportation in Xichang. This will have important demonstration effect to other railway station development in the PRC.

B. Adverse Impacts and Mitigation Measures

203. During construction of the station, potential environmental impacts would include dust generated on construction sites, noise from powered mechanical equipment, wastewater from construction workers and construction activities such as concrete batching, and construction and demolition waste. The station site would not impinge onto ecologically sensitive or protected areas with existing land use dominated by cultivated land. Potential ecological impact is expected to be minimal. The construction workers will be prohibited from capturing wildlife on site during construction. This IEE has assessed the potential impacts and identified effective mitigation measures to reduce such potential impacts to acceptable levels. These mitigation measures have been included in the EMP and will also be included in all tender documents and works contracts for station construction.

204. During operation of the station, potential environmental impacts would include noise from the stations and trains, wastewater and solid waste generated by the workers and passengers at the stations, and electromagnetic impact from the traction substation. The revised EIR and this IEE have identified operational noise mitigation measures, consisting of the provision of noise barriers and double-glazed windows. Wastewater from the station operation would be treated with sequential batch reactor. Upon meeting the effluent standard, treated wastewater would be discharged to nearby drainage ditch leading to water quality category 3 river (the Anning Rvier) that is approximately 1.5 km from the station. Solid waste generated by the passengers and workers would be regularly collected by the local sanitation bureau for disposal at local sanitary landfill. Electromagnetic radiation impact has been assessed by the revised EIR to comply with relevant standards at the boundary of the traction station and adverse impact to nearby

households is not anticipated. Based on the above analysis and provision of treatment and mitigation measures, potential environmental impacts during operation would be minimal.

C. Risks and Assurances

205. The project has no unusual technical risks and conventional engineering designs with proven reliability and performance will be adopted for station construction. From an environment safeguards point of view, the main risk relates to the failure of the PMO, the IA and O&M unit to monitor environmental impacts and implement the EMP during construction and operational stages. This risk will be mitigated by (i) providing training in environmental management under the project; (ii) appointing qualified project management consultant; (iii) following appropriate project implementation monitoring and mitigation arrangements; (iv) ADB conducting regular project reviews; and (v) project assurances covenanted in the loan and project agreement with ADB.

206. General and specific environmental project assurances are required to ensure that the project can achieve its envisaged outcome. The following sections define the assurances that will be included in the loan and project agreements. The EMP also includes a list of environmental contract clauses for inclusion into all tender documents and works contracts, thus binding the contractors legally in the implementation of environmental mitigation measures during construction.

207. **General Environmental Assurances**. CRC as the EA will ensure and cause the IA and the O&M unit to ensure that the preparation, design, construction, implementation, operation, maintenance, monitoring and decommissioning of the project and project facilities comply with (i) all applicable laws and regulations of the Government on environment, health, and safety; (ii) the environmental safeguards (i.e. principles and requirements set forth in ADB's Safeguard Policy Statement (2009); and (iii) all measures and requirements set forth in the domestic environmental impact reports (EIR), this IEE and environmental management plan (EMP) for the project; and any corrective or preventive actions (a) set forth in a safeguards monitoring report, or (b) which are subsequently agreed between ADB and CRC will cause the IA to prepare, at the outset of component implementation, detailed internal monitoring programs to be implemented by the contractors during construction and operation phases, and to incorporate such mitigation and monitoring measures into the design of stations, relevant bidding documents and construction contracts. Throughout project implementation, CRC and the IA will review any changes to the project design that may potentially cause negative environmental impacts, and in consultation with ADB, update IEE and EMP by revising mitigation measures as necessary to assure full environmental compliance.

208. The PMO and IA will appoint environmental coordinators for monitoring EMP implementation and making appropriate use of external independent entities for environmental monitoring and compliance monitoring. CRC will ensure that the IA is obliged to provide annual environmental monitoring reports throughout the construction period to PMO, which will in turn prepare and submit to ADB annual environmental monitoring reports in a format acceptable to ADB.

209. **Specific Environmental Assurances**. CRC will ensure that within 60 days from the loan effectiveness, PMO establishes the project grievance redress mechanism relating to safeguards in line with the EMP and Resettlement Plan and establishes a task force functioning effectively to: (a) review and document eligible complaints of project stakeholders; (b) proactively address grievances; (c) agree with the complainants the chosen mechanism for redress; and (d) prepare

periodic reports to summarize the number of complaints received and resolved, and final outcomes of the grievances and chosen actions and make these reports available to ADB on request. Eligible complaints include those related to the project, any of the service providers, any person responsible for carrying out the project, complaints on misuse of funds and other irregularities and grievances due to any safeguard issues, including resettlement, environment, and gender.

210. CRC will ensure that measures described in the revised EIR, IEE and EMP for operational noise mitigation will be implemented. These measures include the provision of noise barriers and/or double glazed windows at sensitive receptors near the station as identified in the approved revised environmental impact report.

D. Overall Conclusion

211. The domestic EIRs and this IEE conclude that all identified environmental impacts can be mitigated to acceptable levels if the measures defined in the EMP and assurances are carefully implemented and monitored. The project is feasible from an environmental safeguards point of view and will contribute to capacity enhancement of the E'mei–Miyi section of the Chengkun Rail Line.

ENVIRONMENTAL MANAGEMENT PLAN

July 2018

People's Republic of China: Multimodal Passenger Hub and Railway Maintenance Project

Prepared by the China Railway Corporation for the Asian Development Bank.

A. Introduction

1. This Environmental Management Plan (EMP) is developed for the construction of the Xichang West Station (the project) on the E'mei–Miyi section of the Chengkun Rail Line. The EMP identifies the potential environmental impacts and defines mitigation measures and monitoring requirements for the design, construction and operational stages of the station. It also defines the institutional arrangements and mechanisms, the roles and responsibilities of different institutions, procedures and budgets, capacity building and training for implementation of this project-specific EMP. The EMP specifies effective implementation of environmental protection activities during preconstruction, construction, and operation in order to prevent, reduce, or mitigate adverse environmental impacts and risks. The EMP draws on the findings of the project initial environmental examination (IEE) report; the domestic feasibility study report (FSR) and the revised environmental impact report (EIR) for the capacity enhancement of the E'mei–Miyi section; and discussions and agreements with the project executing agency, the implementing agency, and the Asian Development Bank (ADB).

2. This EMP is based on proposed project designs as of October 2015 described in the approved revised EIR. Detailed engineering designs are yet to be finalized and may require subsequent impact assessment and/or revisions to this EMP depending on the extent of changes made and their resulting environmental implications. The China Railway Corporation (CRC)- the EA and the ChengKun Railway Corporation (CRKC)- the IA will provide the detailed designs to ADB for review to determine if the EMP requires revision. The final IEE and EMP will be disclosed on the ADB public website (www.adb.org) and included in the project administration manual (PAM). The final EMP will also be included as a separate annex in all bidding and contract documents for station construction. The contractors will be informed of their obligations to implement the EMP, and to include EMP implementation costs in their bids. The EMP defines the overarching Grievance Redress Mechanism (GRM) for the project. The implementing agency (IA) and contractors for station construction will be made aware of the GRM requirements.

3. This EMP consists of six components: (i) institutional arrangements and environmental responsibility; (ii) environmental mitigation measures; (iii) environmental monitoring; (iv) institutional strengthening and training; (v) public consultation; and (vi) grievance redress mechanism (GRM). Environmental monitoring consists of two types of monitoring: (i) environmental monitoring in terms of environmental data collection and analyses for assessing the extent and severity of impact; and (ii) compliance monitoring (or audit) by independent entities for verifying EMP implementation. The last section of this EMP contains a list of environmental contract clauses for inclusion into all bidding documents and works contracts for environmental protection during station construction.

B. Institutional Arrangements and Responsibilities for EMP Implementation

4. **Executing Agency**. The **China Railway Corporation** (CRC) will be the executing agency (EA) responsible for overall implementation and compliance with loan assurances and the EMP.

Implementing Agency. The ChengKun Railway Corporation (CKRC) will be the implementing agency (IA) for the project. The IA shall implement the project component, administer and monitor contractors and suppliers, and be responsible for construction supervision and quality control. The IA has established Project Management Office (PMO). To support PMO, the IA shall (i) engage tendering agency; (ii) engage the project management consultant (PMC) services and loan implementation environmental consultant (either through PMC or individual engagement); (iii) contract construction supervision companie(s) and environmental supervision engineer, who

can conduct independent evaluation and verification of EMP implementation during the construction stage of the station ; (iv) contract the local Environmental Monitoring Station (EMS) to conduct environmental quality monitoring during the construction stage. To ensure that the contractors comply with the EMP provisions, the IA with the help and technical support of a Tendering Agent and the LIEC, shall prepare and provide the following specification clauses for incorporation into the bidding procedures: (i) a list of environmental management and monitoring requirements to be budgeted by the bidders in their proposals; (ii) environmental clauses for contractual terms and conditions; and (iii) major items in the IEE, and the full EMP.

5. **Project Management Office**. The IA has established a **Project Management Office** (PMO)**,** who shall be responsible, on behalf of the EA/IA, for the day-to-day management of the project. The PMO shall have the overall responsibility of supervising the implementation of environment mitigation and monitoring measures, coordinate the project GRM and report to ADB. The PMO shall appoint at least one environmental coordinator to coordinate and manage EMP implementation, and supervise the procurement process. The PMO environmental coordinator with support of the LIEC shall (i) provide overall co-ordination and support on environmental aspects of station construction; (ii) supervise contractors and their compliance with the EMP; (iii) conduct regular site inspections; (iv) act as PMO entry point for the project GRM; (v) prepare and submit annual environmental monitoring reports and environmental section of quarterly progress report, which containing environmental monitoring data and other relevant information to assess the effectiveness of EMP implementation to ADB, through the EA; (vi) closely communicate with local Environmental Protection Bureau (EPB) for domestic environmental compliance.

6. **Construction Contractors** for the station shall be responsible for implementing the mitigation measures during construction under the supervision of the IA (through the ESE) and PMO. In their bids, contractors shall be required to respond to the environmental management and monitoring requirements defined in the EMP. Each contractor shall be required to assign a person responsible for environment, health and safety.

7. **Loan Implementation Environmental Consultant (LIEC).** A LIEC shall be recruited either through individual contract or under the PMC service contract to support project implementation. Terms of reference for the LIEC are provided in the PAM. The LIEC shall:

- assess the project's environmental readiness prior to implementation based on the readiness indicators defined in Table EMP-3 in the EMP;
- support PMO in updating the EMP including environmental monitoring plan as necessary to revise or incorporate additional environmental mitigation and monitoring measures, budget, institutional arrangements, etc., that may be required based on the detailed design; submit to ADB for approval and disclosure; ensure compliance with the PRC's environmental laws and regulations, ADB's Safeguard Policy Statement (2009) and Public Communications Policy (2011);
- if required, update the IEE and EMP reports for changes during detailed design or project implementation (for example if there is a minor or major scope change) that would result in adverse environmental impacts not within the scope of the approved IEE/EMP;
- assist PMO to establish a GRM;
- conduct EMP compliance audit, undertake site visits as required, identify any environment-related implementation issues, and propose and oversee implementation of necessary corrective actions;

- assist PMO to prepare quarterly project progress reports and annual environmental monitoring reports (EMR) for submission to ADB;
- provide training to PMO, IA and contractors on environmental laws, regulations and policies, SPS 2009, EMP implementation, and GRM in accordance with the training plan defined in the EMP (Table EMP-7); and
- assist PMO and IA in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities, GRM.

8. **Environmental Supervision Engineer (ESE)** 环境监理. The IA shall contract an independent ESE as a part of construction supervision companie(s) to verify environmental performance during construction and whether the implementation of EMP items complies with the plan. The ESE shall review EMP implementation and monitoring activities and results, assess EMP implementation performance, visit the project sites and consult potentially affected people, discuss assessment with the PMO and the IA; and suggest corrective actions where necessary. The ESE shall prepare monthly reports for submission to the IA which shall be submitted to and reviewed by PMO during the preparation of the quarterly project progress reports for ADB and by the LIEC during the preparation of the annual EMRs for ADB.

C. Summary of Potential Impacts and Mitigation Measures

9. Potential environmental issues and impacts during pre-construction, construction and operation phases and corresponding mitigation measures are summarized in Table EMP-2. There are two types of mitigation measures:

- Measures that will permanently become part of the infrastructure such as engineering measures for noise barriers and station wastewater treatment facilities, etc. should be included within the main civil work contract costs, and are not double-counted as part of the EMP costs.
- Temporary measures during the construction stage (e.g. dust suppression by watering, use of quiet / low noise powered mechanical equipment (PME), flocculants used to facilitate sedimentation of suspended solids in construction site runoff, etc.) will need to be included in the tender documents to ensure that contractors budget these items in their bids.

10. The mitigation measures defined in the EMP will be (i) checked and where necessary updated by the design institutes and the EMP subsequently updated; (ii) incorporated into tender documents (where appropriate), construction contracts, and operational management plans; and (iii) implemented by contractors and IA under supervision of PMO. The effectiveness of these measures will be evaluated based on the results of the environmental monitoring conducted by local EMS, and through EMP compliance audits conducted by the ESE and LIEC.

Table EMP-1: Environmental responsibility

Responsible Entity	Project Stage and Environmental Responsibility				
	Project Preparation	**Engineering Detailed Design**	**Tendering & Pre-construction**	**Construction**	**Operation**
CRC	The Executing Agency (**EA**) for the project responsible for overall implementation and compliance with loan assurances and the EMP.				
CKRC	The Implementing Agency (**IA**) for the project responsible for implementing the project component, administering and monitoring contractors and suppliers, and construction supervision and quality control. Shall ensure that the EMP is implemented proactively and shall respond to any adverse impact beyond those foreseen in the IEE and ensure that if there are any changes in scope the IEE/EMP shall be updated, as needed. Shall also attend to requests from relevant agencies and ADB regarding the mitigation measures and environmental monitoring program.				
	• Engage LDIs, EIA institute to prepare FSR, EIR and RP		• Engage a tendering agency • Engage local EMS for environmental monitoring • Engage ESE/CSC for independent compliance audit and verification • Engage LIEC as part of the PMC services • With support from tendering agency and LIEC, ensure IEE/EMP clauses to be incorporated in tender documents and contracts	• Supervise PMO in EMP implementation to ensure effectiveness	• Inform and support CRB on environmental management requirements • Ensure proper operation of station facilities according to design standards
PMO	Established by the IA to be responsible for the day-to-day management of the project. Has overall responsibility delegated by the EA/IA for supervising the implementation of environmental mitigation measures, coordinating the project level GRM and reporting to ADB				
		• Conduct additional meaningful consultation targeting affected people from Xichang station • Update IEE/EMP • Review updated EMP • Confirm that mitigation measures have been included in engineering detailed design	Appoint at least one environmental coordinator on staff • Establish the project complaint center with hot-line	• Supervise contractors and ensure compliance with the EMP • Coordinate construction supervision and quality control • Operate the project complaint center and coordinate the project environment GRM records and reporting. • Inspect implementation of mitigation measures. • Coordinate environmental monitoring according to the environmental monitoring program in the approved EMP • Submit monthly monitoring results to PMO and local EPBs • Prepare quarterly project progress reports and annual EMRs and submit them to ADB • Conduct information disclosure and public consultation 1.	• Coordinate environmental monitoring according to the approved EMP until a PCR is issued • Prepare quarterly project progress reports and annual EMRs until a PCR is issued
Local design institutes (LDIs)	1. Prepare project FSR, EIR, RP 2. Conduct public consultation	1. Incorporate mitigation measures defined in the approved revised EIR and this EMP into engineering detailed designs			

Responsible Entity	Project Stage and Environmental Responsibility				
	Project Preparation	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
		2. Update the EMP in cooperation with the LIEC 3. Incorporate agreed climate adaptation measures into engineering detailed designs..			
Local EPBs				1. Conduct mandated inspection and monitoring Conduct the "Three Simultaneity[1]" acceptance inspections on completion of the project	
Xichang Government		Upon the preparation of FSR and domestic EIA for other associated facilities like bus terminals and other multi-mode transport connection points, inform the IA and ADB and submit the reports for ADB's further due diligence			Consider promoting sustainable tourism
LIEC		1. Review updated EMP, confirm that mitigation measures have been included in engineering detailed design	1. Review bidding documents to ensure that the IEE/EMP clauses are incorporated 2. Confirm project's readiness in respect of environmental management.	1. Advise on mitigation measures 2. Provide technical support to PMO, IA and contractors for environmental management 3. Conduct environmental training 4. Conduct EMP compliance audit 5. Support PMO in preparing quarterly project progress reports and annual EMRs. 6. Review domestic environmental inspection acceptance reports 7. Provide environmental input to the PCR.	1. Conduct EMP performance evaluation and audit 2. Support PMO in instructing CRB on environmental management requirements 3. Support PMO in preparing quarterly project progress reports and annual EMRs until a PCR is issued 4. Coordinate environmental monitoring until a PCR is issued
Contractors			1. Ensure sufficient funding and human resources for proper and timely implementation of required mitigation and monitoring measures in the EMP throughout the construction phase	1. Appoint an environment, health and safety (EHS) officer to oversee EMP implementation related to environment, occupational health and safety on construction site 2. Ensure health and safety 3. Implement mitigation measures 4. Act as a local entry point for the project GRM	
Local EMS 环境监测站				1. Undertake environmental monitoring according to the environmental monitoring program in the approved EMP (*contracted by IA*)	1. Undertake environmental quality monitoring until a PCR is issued (*contracted by IA*) 2. Submit monitoring results to the IA

[1] The "Three Simultaneities" requires the design, construction, and operation of pollution control and treatment facilities to occur simultaneously with the project design, construction, and operation.

Responsible Entity	Project Stage and Environmental Responsibility				
	Project Preparation	**Engineering Detailed Design**	**Tendering & Pre-construction**	**Construction**	**Operation**
				2. Report monitoring data to ESE, IA and PMO	
ESE 环境监理				1. Conduct independent verification of project's environment performance and compliance with the EMP (*contracted by IA*) 2. Review monthly monitoring data submitted by EMS, and conduct compliance checking against applicable environmental standards and report to LIEC. 3. Provide advice to contractors to resolve on-site environmental problems when monitoring data show non-compliance and any environmental complaints raised. 4. Submit monthly compliance auditing results to PMO and IA	
ADB	1. Review and approve the IEE and EMP and disclose on ADB website	1. Approve updated IEE/EMP if appropriate and disclose on ADB website	1. Review bidding documents 2. Review proposed candidates for LIEC to ensure suitably qualified. 3. Confirm project's readiness	1. Review quarterly project progress reports, annual EMRs and PCR 2. Undertake review missions 3. Advise on compliance issues, as required 4. Review and disclose annual EMRs on ADB website.	1. Review and approve EMRs and disclose on ADB website 2. Undertake project completion review mission and prepare PCR for approval by Board and disclosure on ADB website.

ADB = Asian Development Bank; **CKRC** = ChengKun Railway Corporation; **CRB** = Chengdu Railway Bureau; **CRC** = China Railway Corporation; **EA** = executing agency; **EHS** = environment, health & safety; **EIR** = environmental impact report; **EMP** = environmental management plan; **EMR** = environmental monitoring report; **EMS** = Environmental Monitoring Station; **EPB** = Environmental Protection Bureau; **ESE** = environmental supervision engineer; **FSR** = feasibility study report; **GRM** = grievance redress mechanism; **IA** = implementing agency; **IEE** = initial environmental examination **LDI** = local design institute; **PCR** = project completion report; **LIEC** =loan implementation environmental consultant; **PMC** = project management consultant; **PMO** = project management office; **PPTA** = project preparation technical assistance

Table EMP-2: Summary of potential impacts and mitigation measures

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
A: Detailed Design Stage						
Conservation of natural resources	Soil resources	Loss of land and topsoil and increased risk of erosion	● Technical design of the spoil disposal site shall have adequate drainage provisions and mitigation measures described in the revised EIR to prevent soil erosion.	LDI	PMO	Included in design contract
	Materials	Efficient use of resources	● To minimize the quantities of borrow materials and spoil disposal, the reuse of earth cut materials for backfilling shall be maximized.			
Additional due diligence on multimodal transport associated facilities of Xichang station			● Prepare and submit FSR and EIA of multimodal transport associated facilities of Xichang station for ADB's due diligence	Xichang Government	PMO/ADB	Xichang Government
B: Pre-construction Stage						
Institutional strengthening	--	Limited ADB Safeguards experience within PMO and IA	● Appoint qualified staff as the environmental coordinator to oversee EMP implementation.	PMO, IA	ADB	PMO, IA
			● Contract PMC services. PMC shall have an environmental specialist on the team to undertake the role of LIEC ● Conduct environment management training.	PMO	ADB	PMO
	--	Lack of environmental monitoring and supervision capability and qualification	● Contract local EMS (环境监测站) to conduct environmental monitoring during construction and operation. ● Appoint an environmental supervision engineer (ESE,环境监理) responsible for the environmental supervision of contractors and environmental audit of construction sites.	IA	PMO	IA
Grievance redress mechanism	--	Establish a system for receiving and resolving complaints	● Establish a project-specific grievance redress mechanism (GRM) including a complaint hotline. ● Brief and provide training to other GRM access points (IA, contractors). ● Conduct additional meaningful consultation targeting affected people from Xichang station	PMO	ADB	PMO, PMC service
EMP Update	--	-	● Review mitigation measures defined in this EMP, update as required to reflect changes made during detailed design, disclose updated EMP on project website.	PMO, LIEC	ADB	PMO, PMC
Tender and contract documents	--	Environmental contract clauses-	● Put the environmental contract clauses listed in Section J of this EMP into all civil works tender documents and contracts and ensure adequate cost provision.	PMO, Tendering Agent	LIEC, ADB	Included in tendering agency contract
						Estimated cost for Design and Pre-construction stage: Included in detailed design and contract tender fees
C: Construction Stage						
Construction site good practice	Air quality	Dust (TSP) during construction	● Site concrete batching stations specifically for station construction at least 300 m downwind of the nearest household ● Equip concrete batching plants with fabric filters and/or wet scrubbers to reduce the level of dust emissions. ● Provide personal protective equipment (PPE) such as goggles, gloves and respirators to construction workers where necessary to minimize skin exposure to and inhalation of fumes and dust. ● Spray water at least twice each day on unpaved areas, haul roads and exposed dust-prone stockpiles except on rainy days. ● Pave frequently travelled haul roads and construction site and construction staging area exits with gravel or asphalt. ● Control vehicle speed to ≤ 8 km/h in unpaved areas including unpaved haul roads. Post the speed limit sign in these areas. ● Install wheel washing equipment or conduct wheel washing manually at each exit of the works area and concrete batching station to prevent trucks from carrying muddy or dusty substance onto public roads. ● Store dust-prone materials in areas with shelters on four sides and on top. If such materials have to be stored in open area, cover with strong tarpaulin. ● Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin. ● Regularly maintain construction vehicles and machinery to minimize exhaust emissions from these sources. ● Unauthorized burning of construction waste material and refuse shall be subject to penalties for the Contractor, and withholding of payment.	Contractor	IA, ESE, LIEC	$65,000 (contractor bid)
	Noise and vibration	Noise from PME and vehicles	● During daytime construction, the contractor will: ■ properly maintain machinery to minimize noise;	Contractor	IA, ESE, LIEC	$65,000 (contractor bid)

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			▪ deploy low noise machinery or the equipment with sound insulation when working within 100 m from villages or townships; ▪ site concrete batching stations specifically for station construction at least 300 m away and downwind (for air quality purpose) from the nearest sensitive receptor; and ▪ erect temporary noise barriers or hoardings around the equipment to shield the noise from equipment when there are residences, schools, health clinics or mosques within 50 m of the noise source. ● There will be no night time (between 22:00 and 06:00 hours) construction. ● Provide the construction workers with suitable hearing protection (ear muffs). ● Ensure regular equipment repair and maintenance to keep them in good working condition. ● Forbid the use of horns unless absolutely necessary, minimize the use of whistles.			
	Water quality	Construction site runoff and wastewater discharge	● Provide portable toilets and small package wastewater treatment plants and/or septic tanks on construction sites and construction camps for the workers. If there are nearby public sewers, install interim storage tanks and pipelines to convey wastewater to public sewers. Collect and treat site runoff from construction sites and construction camps with drainage provisions. ● Install and operate sedimentation tanks on construction sites and concrete batching stations to treat process water (e.g. concrete batching) and muddy runoff with high concentrations of suspended solids. If necessary, use flocculants such as polyacryl amide (PAM) to facilitate sedimentation. ● Site storage and refueling facilities for fuels, oil, and other hazardous materials within secured areas on impermeable surfaces at least 300 m away from water bodies, and provided with bunds and cleanup kits. If refueling in the field is required, it shall be done from road-licensed fuel trucks away from watercourses or other environmentally sensitive areas. ● Protect material stockpiles against wind and runoff water which might transport them to surface waters. There shall be no storage of materials and equipment in or close to water bodies. ● Clean up any chemical spills into drains and water bodies within 24 hours of the occurrence, with contaminated soils and water treated according to *Technical guidelines for site soil remediation* (HJ 25.4-2014). Records must be handed over without delay to the PMO and local EPB.	Contractor	IA, ESE, LIEC	$110,000 (contractor bid)
	Solid waste	Construction site refuse and construction waste	● Maximize the re-use of construction wastes on the project. ● Site borrow area and spoil disposal site for station construction at least 300 m from residential areas so as to reduce potential dust and noise impacts from these sites. ● Include all soil erosion prevention measures listed in the approved revised EIR in the design of borrow area and spoil disposal site. ● Rehabilitate and vegetate spent borrow area and spoil disposal site within one month after closure to prevent soil erosion and dust generation. ● Store all refuse and construction waste generated on construction sites in designated areas and remove them from these locations for disposal or reuse regularly.	Contractor	IA, ESE, LIEC	$95,000 (contractor bid)
	Soil resources	Soil erosion	● Install and implement soil erosion prevention measures in all construction sites, construction staging areas, borrow areas and spoil disposal sites in accordance with requirements in the approved revised EIR. ● Pay close attention to drainage provision and establishment of vegetation cover on backfilled areas to prevent soil erosion. ● If restoration is carried out during periods of hot or extreme weather, ensure adequate aftercare to maximize survival of vegetation.	Contractor	IA, ESE, LIEC	Included in the implementation of the approved revised EIR
	Ecology	Destruction of vegetation and wildlife	● Construction workers are prohibited from capturing any wildlife during construction. ● Protect existing trees and grassland during construction; remove trees or shrubs only as the last resort if they impinge directly on the permanent works or necessary temporary works. ● Where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area after construction.	Contractor	IA, ESE, LIEC	None
	Physical cultural resources	Destruction of buried cultural relics	● Comply with PRC's *Cultural Relics Protection Law* and *Cultural Relics Protection Law Implementation Ordinance* if such relics are discovered, stop work immediately and notify the local cultural authority, adopt measures to protect the site.	Contractor	IA, ESE, LIEC	None

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
	Overall disturbance to communities	Excessive disturbance to communities due to prolonged construction times	● Identify and adhere to strict schedule for completion of civil works and avoid prolonged construction and disturbance. ● Keep communities informed of construction activities, in particular those that may result in disruption of access, noisy or dust-generating activities that are likely to result in significant disturbance. Ensure communities are aware of Grievance Redress Mechanism entry points.	Contractor	IA, ESE, LIEC	None
Health and Safety	Occupational health and safety	Environment, health & safety officer	● Appoint at least one environment, health and safety (EHS) officer to manage occupational health and safety risks on construction sites by applying the following measures.	Contractor	IA, ESE, LIEC	(contractor staff)
		Construction site sanitation	● Provide adequate and functional systems for sanitary conditions, toilet facilities, waste management with waste separation, labor dormitories and cooking facilities. ● Effectively clean and disinfect the site. During site formation, spray with phenolated water for disinfection. Disinfect toilets and refuse bins and ensure timely removal of solid waste. ● Exterminate rodents on site at least once every 3 months, and exterminate mosquitoes and flies at least twice each year. ● Provide public toilets in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and appoint designated staff responsible for cleaning and disinfection ● Discharge construction site domestic wastewater into the municipal sewer system or treated on-site using a portable system.	Contractor	IA, ESE, LIEC	Included in water quality above (contractor bid)
		Occupational safety	● Provide personal protective equipment (safety hats and shoes, high visibility vests and safety belt and harness for above ground works) to all construction workers and strictly enforce all workers to put on the PPE. ● Provide safety goggles, gloves and respiratory masks to workers doing interior fit-out works. ● Provide ear plugs to workers operating and working near noisy PME.	Contractor	IA, ESE, LIEC	$15,000 (contractor bid)
		Food safety	● Inspect and supervise food hygiene in canteens on site regularly. Canteen workers must have valid health permits. ● If food poisoning is discovered, implement effective control measures immediately to prevent it from spreading.	Contractor	IA, ESE, LIEC	None
		Disease prevention and safety awareness	● Construction workers must have physical examination before starting work on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. From the second year onwards, conduct physical examination on 20% of the workers every year. ● Establish health clinic at location where workers are concentrated, which should be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents. ● Provide induction and training by local health departments on prevention and management of communicable diseases.	Contractor	IA, ESE, LIEC	$10,000 (contractor bid)
	Community health and safety	Temporary traffic management	● Prepare a traffic control and operation plan together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.	Contractor, local traffic police	IA, ESE, LIEC	None
		Information disclosure	● Erect construction billboards, which include construction contents, schedule, responsible person and complaint phone number, at the entry to each construction site and construction staging area. ● Inform residents and businesses in advance of the road improvement activities, given the dates and duration of expected disruption and make aware of the project GRM. ● Place clear signs at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc. and raising awareness on safety issues.	Contractor	IA, ESE, LIEC	None
		Access to construction sites	● Make all sites secure, and discourage access by members of the public through appropriate fencing, signage and/or security personnel, as appropriate.	Contractor	IA, ESE, LIEC	None
		Utility services interruptions	● Assess construction locations in advance and identify potential for disruption to services and risks before starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities is subject to full compensation, at the full liability of the contractor who caused the problem.	Contractor, local utility service providers	IA, ESE, LIEC	None

Item	Impact Factor	Potential Impact and/or Issues	Mitigation Measures	Implementing Entity	Supervising Entity	Source of funds
			● If temporary disruption is unavoidable, develop a plan in collaboration with relevant local authorities such as power company, water supply company and communication company to minimize the disruption and communicate the dates and duration in advance to affected persons.			
Grievance redress mechanism	Social & environmental	Handling and resolving complaints on contractors	● Appoint a GRM coordinator ● Disclose GRM to affected people before construction begins at the main entrance to each construction site. ● Maintain and update a Complaint Register to document all complaints.	Contractor, IA	PMO, LIEC	Contractor and IA budget
						Estimated cost for the Construction Stage: $360,000 (Amount included in contractor bids)
D: Operation Stage						
Water quality	Wastewater discharge from the SBR	Water quality impact on Anning River	● Regularly maintain the SBR to ensure that the treated effluent complies with applicable effluent discharge standards for category 3 water body.	CRB	PMO	CRB operating budget
Noise	--	Noise from train and station operation	● Installation of noise barriers and provision of double-glazed windows for operational noise mitigation as specified in the approved revised EIR shall be completed prior to PCR. (**Note**: noise barrier is part of the civil works and cost will be included in the contractor's bid on civil works. Double-glazed window cost estimate of CNY365,000 (CNY500/m^2 x 730 m^2) will also be included in contractor bids.	IA	PMO	Included in civil works contract
EIA post assessment	Operational impact	Effectiveness of project design and mitigation measures	● Appoint qualified entity to conduct an EIA post assessment of the project at the end of 3 years after commissioning of station operation, in accordance with *Management measures for environmental impact post assessment of construction projects* (MEP decree [2015] No. 37) requirements	CRB	PMO	CRB operating budget
Induced impacts on tourism	Local development	Promoting sustainable tourism	● Considering general increase of tourists in Xichang area and potential impacts associated with mass tourism, sustainable tourism shall be promoted through ongoing dialogues with relevant government authority in Xichang	CRB	PMO	CRB operating budget

ADB = Asian Development Bank; **CRB** = Chengdu Railway Bureau; **EHS** = environment, health & safety; **EIR** = environmental impact report 环境影响报告书; **EMP** = environmental management plan; **EMS** = Environmental Monitoring Station 环境监测站; **EPB** = Environmental Protection Bureau; **ESE** = Environmental supervision engineer 环境监理; **FSR** = feasibility study report; **GRM** = grievance redress mechanism; **IA** = implementing agency; **IEE** = initial environmental examination; **LDI** = local design institute; **LIEC** = loan implementation environmental consultant; **PMC** = project management consultant; **PME** = powered mechanical equipment; **PMO** = project management office; **PPE** = personal protective equipment; **PRC** = :People's Republic of China; **SBR** = sequential batch reactor; **TSP** = total suspended particulates.

D. Monitoring and Reporting

11. Three types of project monitoring will be conducted under the EMP. [2]

i. Project readiness monitoring. To be conducted by the LIEC or PMO environmental coordinator (under the support of LIEC).

ii. EMP Environmental monitoring. To be conducted by local EMS (contracted by the IA) involving the collection and analyses of air quality, noise and water quality data at designated monitoring locations to assess compliance with applicable environmental quality and emission standards during construction.

iii. EMP evaluation or auditing. To be conducted by the ESE (contracted by the IA) and LIEC to verify EMP compliance during project implementation. The LIEC will function as an independent evaluator/auditor for ADB.

12. ADB will oversee project compliance on the basis of the quarterly project progress reports and annual environmental monitoring reports provided by PMO and site visits (generally 1-2 times per year). Monitoring and reporting arrangements are described below.

13. **Project Readiness Monitoring.** Before construction, the LIEC shall assess the project's readiness on environmental management based on a set of indicators (Table EMP-3) and report it to ADB and PMO. This assessment shall demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table EMP-3: Project readiness assessment indicators

Indicator	Criteria	Assessment
EMP update	• EMP was updated after technical detail design & approved by ADB	Yes No
Compliance with loan covenants	• The borrower complies with loan covenants related to project design and environmental management planning	Yes No
Public involvement effectiveness	• Meaningful consultation completed	Yes No
	• GRM established with entry points	Yes No
Environmental supervision and monitoring in place	• Loan implementation environmental consultant (LIEC) is in place	Yes No
	• Staff environmental coordinators appointed by PMO and IA	Yes No
	• Environmental supervision engineers (ESE) contracted by IA	Yes No
	• Environment monitoring stations (EMS) contracted by IA	Yes No
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances	Yes No
	• Bidding documents and contracts incorporating the environmental contract clauses listed in Section J of the EMP	Yes No
EMP financial support	• The required funds, if applicable, have been set aside for EMP implementation	Yes No

[2] In addition to project-specific monitoring, local EPBs will conduct independent ambient and/or enforcement monitoring as per national requirements. This is separate to, and not funded by, the project.

14. **EMP Environmental Monitoring.** Table EMP-4 shows the environmental monitoring program designed for the project, defining the scope, location, parameter, duration and frequency, and responsible agencies, for monitoring during the construction and operational stages. Environmental monitoring shall include monitoring of air quality, noise and water quality during construction; and water quality and electromagnetic radiation during operation. These will be conducted by local EMSs (contracted by the IA). The selection of monitoring locations is based on distances from the station sites, number of households and populations affected, and the extent of sensitivity to air, noise and water quality impacts (e.g. residential household, school).

15. The monitoring results shall be compared with relevant PRC performance standards (Table EMP-5). Non-compliance with these standards shall be highlighted in the EMRs. Monitoring results shall be submitted by the EMSs to the IA, ESE and local EPBs on a quarterly basis. In turn, the IA shall submit the data to PMO and LIEC also on a quarterly basis. PMO shall then submit to ADB in the annual EMRs (prepared with the support of the LIEC–Table EMP-6).

Table EMP-4: Environmental monitoring program

Monitoring Location	Item	Monitoring Parameter	Monitoring Frequency & Duration	Implementing Entity	Supervising Entity
Construction stage					
1. Taihe Village 太和村 2. Zhongxin Village 中心村 3. Xinfu Village 新富村	Air quality	TSP 24-h average	2 consecutive days (24-hr) every 3 months until a PCR is issued	Local EMS	CKRC, ESE
	Noise	L_{Aeq}	2 consecutive days (day time only) every 3 months until a PCR is issued [no night time construction allowed]		
Discharge point of each sedimentation tank on construction site and concrete batching station	Water quality	pH, SS	2 consecutive days every 3 months until the sedimentation tank is decommissioned	Local EMS	CKRC, ESE
					Estimated cost : $26,500
Operational Stage					
1. Taihe Village 太和村 2. Zhongxin Village 中心村 3. Xinfu Village 新富村	Noise	L_{Aeq}	2 consecutive days (day time and night time) every month until a PCR is issued.	Local EMS	CRB
Discharge point of the station's sequential batch reactor wastewater treatment system	Water quality	pH, SS, COD, BOD_5, NH_3-N, TPH, coliform bacteria	2 consecutive days per month until a PCR is issued	Local EMS	CRB
At the boundary walls of the traction substation	Electromagnetic radiation	Magnetic induction strength (mT)	2 consecutive days (24-hr) per month until a PCR is issued. Can cease monitoring if data comply with HJ 24–2014 standards.	Local EMS	CRB
		Electric field strength (V/m)			
					Total estimated cost: $10,500

BOD_5 = 5-day biochemical oxygen demand; **CKRC** = ChengKun Railway Corporation; **CRB** = Chengdu Railway Bureau; **COD** = chemical oxygen demand; **EMS** = Environmental Monitoring Station 环境监测站; **ESE** = environmental supervision engineer 环境监理; **NH_3-N** = ammonia nitrogen; **L_{Aeq}** = A-weight equivalent sound pressure level; **PCR** = project completion report; pH = acidity & alkalinity; **SS** = suspended solids; **TPH** = total petroleum hydrocarbon (= oil & grease) **TSP** = total suspended particulates;

Table EMP-5: Monitoring indicators and applicable PRC standards[3]

Phase	Indicator	Standard
Construction	TSP	*Ambient air quality standard* (GB 3095-2012) Class II standard
	Noise limits of PME at boundary of construction site	*Emission standard of environmental noise for boundary of construction site* (GB 12523-2011)
	Water quality	*Integrated wastewater discharge standard* (GB 8978–1996) Class I standard
Operation	Noise	*Environmental quality standard for noise* (GB 3096–2008) Noise functional area categories 2 and 4b standards
	Water quality	*Integrated wastewater discharge standard* (GB 8978–1996) Class I standard
	Electromagnetic radiation	*Technical guidelines for environmental impact assessment of electric power transmission and distribution project* (HJ 24–2014)
Note: **PME** = powered mechanical equipment		

16. **Independent EMP Evaluation.** Independent evaluation of EMP implementation shall be undertaken by the ESE and LIEC. The LIEC shall be recruited as an individual consultant under the PMC contract. PMO shall report the LIEC's independent evaluation to ADB on the project's adherence to the EMP, information on project implementation, environmental performance of the contractors, and environmental compliance through quarterly project progress reports and annual EMRs (Table EMP-6). The LIEC shall visit the project sites at least twice a year and support PMO in developing the annual EMRs. The reports should confirm the project's compliance with the EMP and local legislation (including the PRC's environmental assessment and implementation requirements), the results of independent evaluation (both contractor compliance with the EMP and the results of environmental monitoring by local EMSs), identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. Operation and performance of the project GRM, environmental institutional strengthening and training, public consultation, compliance with all covenants under the project and site photographs shall also be included in the report. A template for the Environmental Monitoring Report is included in the Project Administration Manual (PAM).

17. **Monitoring by ADB.** Besides reviewing the annual EMRs from PMO, ADB missions will inspect the project progress and implementation on site at least once a year. For environmental issues, inspections will focus mainly on (i) environmental monitoring data; (ii) the implementation status of subproject performance indicators specified in the loan documents for the environment, environmental compliance, implementation of the EMP, and environmental institutional strengthening and training; (iii) the environmental performance of contractors, ESEs, LIEC, IA and PMO; and (iv) operation and performance of the project GRM and ongoing information disclosure and public consultation. The performance of the contractors in respect of environmental compliance will be recorded and will be considered in the next bid evaluations. ADB also prepares the final Project Completion Report (PCR).

18. **Environmental Acceptance Monitoring and Reporting.** Following the PRC's *Management measures for inspection and acceptance of environmental protection at construction project completion* (MEP Decree [2001] No. 13 and 2010 amendment), within three months after the completion of the project construction, an environmental acceptance monitoring and audit

[3] The project applies PRC standards. A comparison of PRC standards with internationally accepted standards (as defined in the World Bank's Environment Health and Safety Guidelines) was conducted for the IEE. The comparison confirmed that PRC standards are either internationally accepted, or have comparable standard limits with most of the international standards.

report for the project shall be prepared by an organization specified under PRC's *Construction Project Environmental Protection Management Ordinance* (amended 2017). The report shall be reviewed and approved by the local EPB, and then reported to ADB (Table EMP-6). The environmental acceptance report for the completed project shall indicate the timing, extent, effectiveness of completed mitigation and maintenance, and the needs for additional mitigation measures and monitoring during operation. The PMO with support of the LIEC shall prepare a draft Project Completion Report which includes an environment chapter.

Table EMP-6: Reporting plan

Reports		From	To	Frequency
Construction Phase				
Internal progress report by contractors	Internal project progress report by construction contractors, including monitoring results	Contractors	PMO, IA	Monthly
Progress report	Project progress report	PMO (with LIEC support)	ADB	Quarterly
Environmental monitoring and compliance monitoring report	Environmental monitoring data report	EMSs	Local EPBs, IA, PMO, ESE, LIEC	Quarterly
	Environment monitoring report (EMR)	PMO (with LIEC support)	ADB	Annually
Acceptance report	Environmental acceptance monitoring and audit report	Licensed institute	Local EPBs	Once; within 3 months of completion of physical works
Operational Phase				
Progress report	Project progress report	PMO	ADB	Quarterly until a PCR is issued
Environmental monitoring	Environmental monitoring data report	Local EMSs	Local EPBs, PMO, O&M unit	Quarterly until a PCR is issued
	Environment monitoring report (EMR)	PMO (with LIEC support)	ADB	Annually until a PCR is issued
Project completion report	Draft project completion report including environmental chapter	PMO (with LIEC support)	ADB	On completion
	Final project completion report	ADB	ADB	On completion

ADB = Asian Development Bank; **LIEC** = external environmental monitor; **EMR** = environmental monitoring report; **EMS** = Environmental Monitoring Station; **EPB** = Environmental Protection Bureau; **ESE** = environmental supervision engineer; **IA** = implementing agency; **PCR** = project completion report; **PMO** = project management office.

E. Institutional Capacity Building and Training

19. The capacity of PMO, IA and contractors' staff responsible for EMP implementation and supervision shall be strengthened. All parties involved in implementing and supervising the EMP must have an understanding of the goals, methods, and practices of project environmental management. The project will address the lack of capacity and expertise in environmental management through (i) institutional capacity building, and (ii) training.

20. **Institutional Strengthening**. The capacities of PMO and IA to coordinate environmental management shall be strengthened through a set of measures:

(i) PMC shall support PMO with appointment of an international environment consultant and a national environment consultant as the LIEC to provide support

on environmental management for the project, and to guide PMO and IA in implementing the EMP and ensuring compliance with ADB's Safeguard Policy Statement (SPS 2009);

(ii) The appointment of qualified staff within the PMO and IA as environmental coordinators in charge of EMP coordination, implementation and site inspections including GRM;

(iii) The commissioning of an independent ESE by the IA to provide independent monitoring and verification of EMP implementation.

21. **Training**. PMO, IA and contractors shall receive training in EMP implementation, supervision, and reporting, and on the GRM (**Table EMP-7**). Training shall be facilitated by the LIEC with support of experts under the PMC services, as needed.

Table EMP-7: Training program

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
EMP adjustment and implementation	PMO, IA, contractors	Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of project implementation	2	20	100	$8,000
Grievance Redress Mechanism	PMO, IA, contractors, local EPBs	Roles and responsibilities, procedures, review of experience (after 12 months)	Twice - Once prior to, and once after the first year of project implementation	1	15	100	$3,000
Environmental protection	PMO, IA, contractors	Pollution control on construction sites (air, noise, wastewater, solid waste), use of PPE during construction and operation, occupational health and safety	Once (during project implementation)	2	15	100	$3,000
Environmental monitoring	PMO, IA, contractors	Monitoring methods, data collection and processing, reporting systems	Once (at beginning of project construction)	1	10	100	$1,000
						Total estimated cost:	**$15,000**

EPB = Environmental Protection Bureau; **IA** = implementing agency; **PMO** = project management office;; **PPE** = personal protective equipment.

22. **Capacity Building**. In addition to training for EMP implementation, the project shall provide consulting services and training to assist and train the staff of PMO and IA in project management, environmental management, land acquisition and resettlement, procurement, as well as external resettlement and environmental monitoring.

F. Consultation, Participation and Information Disclosure

23. **Consultation During Project Preparation**. Section VII of the IEE describes the public participation and consultation carried out during project preparation.

24. **Future Public Consultation Plan**. Plans for public involvement during construction and operation stages were developed during project preparation. These include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages; (ii) evaluating environmental and economic benefits and social impacts; and (iii) interviewing the public after the project is completed. These plans include several types of public involvement such as site visits, interviews, workshops and investigation of specific issues (Table EMP-8).

Table EMP-8: Public consultation plan

Organizer	Format	No. of Times	Subject	Attendees	Budget
Construction Stage					
PMO	Public consultation & site visit	4 times: 1 time before construction commences and 1 time each year during construction	Adjusting of mitigation measures, if necessary; construction impact; safety near construction sites; comments and suggestions	Residents adjacent to the project sites, representatives of local communities	$5,000
PMO	Expert workshop / press conference	As needed based on public consultation	Comments / suggestions on mitigation measures, public opinions	Experts of various sectors, media	$2,000
Operational Stage					
PMO, IA	Public consultation and site visits	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Residents adjacent to subproject sites, social sectors	$1,500
PMO, IA	Expert workshop or press conference	As needed based on public consultation	Comments and suggestions on operational impacts, public opinions	Experts of various sectors, media	$1,500
				Total budget:	**$10,000**

IA = implementing agency; **PMO** =project management office.

G. Grievance Redress Mechanism

25. A Grievance Redress Mechanism (GRM) shall be established as part of this EMP to receive and manage any public concerns or issues which may arise due to the project. The GRM comprises: (i) a set of clear procedures developed by PMO to receive, record, and address any concerns which are raised; (ii) specific contact details for individuals at the PMO, IA and the contractors, and (iii) the local EPBs.

26. All contractors and work staff shall be briefed by the PMO on the GRM. Contractors and workers shall be instructed to be courteous to local residents and, in the event they are approached by the general public with an issue, to immediately halt their work and report the issue to the foreman. The foreman shall immediately report the issue to the IA or PMO for action.

27. There are multiple entry points to the GRM, including face-to-face meetings, written complaints, hotline number and telephone conversations, anonymous drop-boxes for written comments, and/or e-mail. All concerns received shall be treated confidentially and professionally. The identity of individuals shall not be circulated among project agencies or staff and shall only be shared with senior staff, and then only when there is clear justification. In the construction period and the initial operational period covered by loan covenants, PMO shall report on GRM to ADB, including complaints and their resolution in the quarterly project progress reports and annual environmental monitoring reports up to the project completion report.

28. Basic steps for resolving complaints are as follows and illustrated in Figure EMP-1.

Step 1: For environmental problems during the construction and operational stages, the affected person (AP) can register his/her complaint directly with the contractors or with the PMO complaint center via its hotline. A joint hotline for resettlement and environment issues shall be established within PMO. Complaints related to land acquisition and resettlement issues shall be directed to the PMO and relevant agencies in accordance with the resettlement plan (RP). Contractors are required to set up a complaint hotline and designate a person in charge of handling complaints, and advertise the hotline number at the main entrance to each construction site, together with the hotline number of the PMO complaint center. The contractors are required to maintain and update a Complaint Register to document all complaints. The contractors are also required to respond to the complainant in writing within 7 calendar days on their proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, this can be recorded by the PMO complaint center and follow-up shall be carried out during the next project site visit by the LIEC. The contractors are required to report complaints received, handled, resolved and unresolved to the PMO complaint center immediately, and to the IA and PMO monthly (through progress reporting).

Step 2: If no appropriate solution can be found during step 1, the contractor has the obligation to forward the complaint to the PMO complaint center, the IA and local EPBs. For an oral complaint, proper written records shall be made. Once a complaint is registered and put on file, the PMO complaint center shall assess the eligibility of the complaint, identify the solution and provide a clear reply for the complainant within 14 calendar days. The LIEC shall assist the PMO complaint center in addressing the complaint, and follow-up with the AP. The PMO complaint center shall also inform the ADB project team and submit all relevant documents. Meanwhile, the PMO complaint center shall convey the complaint/grievance and suggested solution to the contractors, and/or IA's O&M unit in a timely manner. The contractors during construction and the O&M unit during operation shall implement the agreed redress solution and report the outcome to the PMO complaint center within fifteen (15) working days.

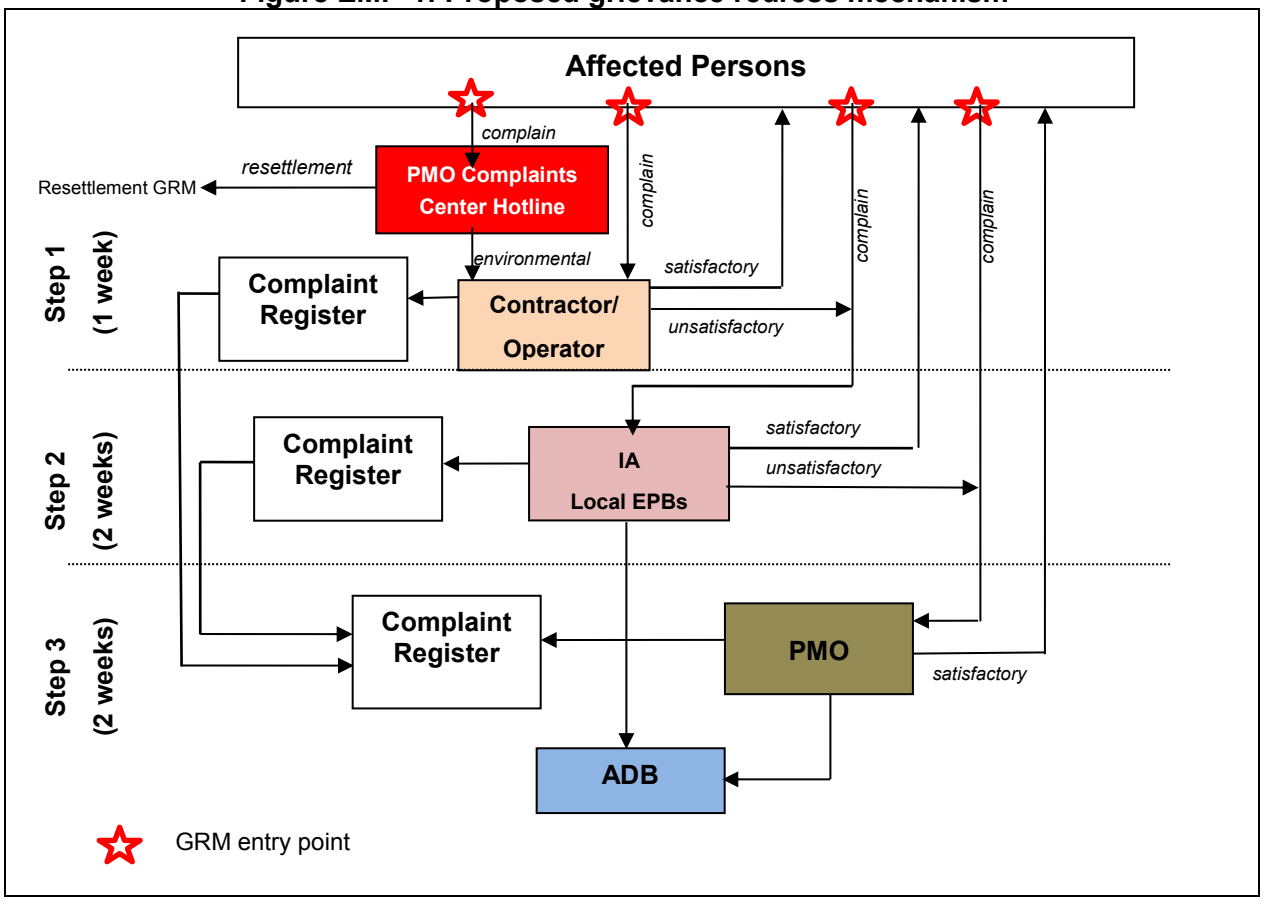
Step 3: In case no solution can be identified by the PMO complaint center, or the complainant is not satisfied with the proposed solution, the PMO complaint center shall organize, within 14 calendar days, a multi-stakeholder hearing (meeting) involving all relevant stakeholders (including the complainant, IA, contractors, O&M unit, local EPB, and PMO). The hearing shall identify a solution acceptable to all, and formulate an action plan.

29. The tracking and documenting of grievance resolutions by PMO shall include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) regular updating of the GRM database by the PMO environmental coordinator; (iii) processes for informing stakeholders about the status of a case; and (iv) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

30. If the above steps are unsuccessful, persons who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism through Office of the Special Project Facilitator (OSPF) or Office of Compliance Review Panel. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make a good faith effort to solve their problems by working with the concerned ADB operations department.

Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[4]

Figure EMP-1: Proposed grievance redress mechanism



H. Cost Estimates

31. The total cost for EMP implementation comprises: (i) mitigation measures (Table EMP-2); (ii) environmental monitoring by local EMSs (Table EMP-4); (iii) supervision of EMP implementation by ESE, (iv) public consultation (Table EMP-7); (v) training (Table EMP-8); and (vi) the compliance monitoring, training and reporting by LIEC. The total cost is summarized in Table EMP-9 and is $847,000. Of this total the mitigation cost of $360,000 would have been included in the civil works costs in the contractor bids for implementing environmental mitigation measures for air quality, noise, water quality and solid waste on construction sites. The budget allocation is indicated in the notes accompanying Table EMP-9.

[4] See: http://compliance.adb.org/.

Table EMP-9: Estimated budget for environmental management plan implementation

EMP Item	Estimated Cost	
	EA or IA Funded	ADB Funded
Environment Training[1]		$15,000
Mitigation measures[2]	$360,000	
Environmental monitoring by local EMS[3]	$37,000	
Environmental supervision by ESE[4]	$375,000	
External compliance monitoring by LIEC (10 months@$5000)[5]		$50,000
Public consultation[6]		$10,000
Subtotal:	$772,000	$75,000
Total:	**$847,000**	
Notes: ADB = Asian Development Bank; **EA** = executing agency; **EMP** = environmental management plan; **EMS** = Environmental Monitoring Station; **ESE** = environmental supervision engineer; **IA** = implementing agency. **LIEC** = loan implementation environmental consultant;		

[1] Included in Project Management Consultant Services training budget
[2] Included in civil works contract - contractors' bids
[3] Included in environmental monitoring costs paid by IA
[4] Included in Environmental Supervision Engineer costs paid by IA
[5] Included in Project Management Consultant Services
[6] Included in Project Management Consultant Services

32. Excluded from the budget are (i) infrastructure costs which relate to environment and public health but which are already included in the project direct costs; and (ii) remuneration for the PMO and IA environment coordinators and consulting packages for the non-structural components, (covered elsewhere in the project budget).

33. Contractors shall bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities. The O&M unit shall bear the costs related to mitigation measures during operation if needed.

I. Mechanisms for Feedback and Adjustment

34. The EMP is a living document. The need to update and adjust the EMP shall be reviewed when there are design changes, changes in construction methods and program, unfavorable environmental monitoring results, monitoring locations are no longer appropriate or mitigation measures are inadequate or ineffective. Based on environmental monitoring and reporting systems in place, PMO (with the support of the LIEC) shall assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. PMO will inform ADB promptly on any changes to the project and needed adjustments to the EMP. The updated EMP shall be submitted to ADB for review and approval, and will be disclosed on the ADB project website, if required.

J. Environmental Contract Clauses for Inclusion into Tender Documents and Civil Works Contracts

39. The following contract clauses for safeguarding the environment during construction shall be incorporated into all the tender documents and works contracts.

1. Construction time:

1.1 There shall be no night time (between 22:00 and 06:00 hours) construction.

2. Protection of air quality

2.1 Concrete batching station specifically for railway station construction shall be sited at least 300 m downwind of the nearest household

2.2 Concrete batching plant shall be equipped with fabric filters and/or wet scrubbers to reduce the level of dust emissions.

2.3 Personal protective equipment (PPE) such as goggles, gloves and respirators shall be provided to construction workers where necessary to minimize skin exposure to and inhalation of fumes and dust.

2.4 Unpaved areas, haul roads and exposed dust-prone stockpiles shall be sprayed with water at least twice each day except on rainy days

2.5 Frequently travelled haul roads and construction site and construction staging area exits shall be paved with gravel or asphalt.

2.6 Vehicle speed in unpaved areas including unpaved haul roads shall be controlled to ≤ 8 km/h. Speed limit signs shall be posted in these areas.

2.7 Wheel washing equipment shall be installed or wheel washing shall be conducted manually at each exit of the works area and concrete batching station to prevent trucks from carrying muddy or dusty substance onto public roads.

2.8 Dust-prone materials shall be stored in areas with shelters on four sides and on top. If such materials have to be stored in open area, cover with strong tarpaulin.

2.9 Vehicles with an open load-carrying case, which transport potentially dust-producing materials, shall have proper fitting sides and tail boards. Dust-prone materials shall not be loaded to a level higher than the side and tail boards, and shall always be covered with a strong tarpaulin.

2.10 Construction vehicles and machinery shall be regularly maintained to minimize exhaust emissions from these sources.

2.11 Unauthorized burning of construction waste material and refuse shall be subject to penalties for the Contractor, and withholding of payment.

3. Protection of the acoustic environment

3.1 Machinery and equipment shall be maintained and repaired regularly and properly to keep them in good working condition and to minimize noise.

3.2 Low noise machinery or equipment with sound insulation shall be deployed when working within 100 m from villages or townships.

3.3 Concrete batching plant specifically for railway station construction shall be sited at least 300 m away and downwind (for air quality purpose) from the nearest sensitive receptor.

3.4 Temporary noise barriers or hoardings shall be erected around the equipment to shield the noise from equipment when there are residences, schools, health clinics or mosques within 50 m of the noise source.

3.5 Suitable hearing protection (such as ear muffs) shall be provided to construction workers when working near noisy machinery.

3.6 The use of horns is forbidden unless absolutely necessary. The use of whistles shall be minimized.

4. Protection of water quality

4.1 Portable toilets and small package wastewater treatment plants and/or septic tanks shall be provided on construction sites and construction camps for the workers. If there are nearby public sewers, interim storage tanks and pipelines shall be installed to convey wastewater to public sewers. Runoff from construction sites and construction camps shall be collected and treated with drainage provisions.

4.2 Sedimentation tanks shall be installed and operated on construction sites and concrete batching station to treat process water (e.g. concrete batching) and muddy runoff with high concentrations of suspended solids. If necessary, flocculants such as polyacryl amide (PAM) shall be used to facilitate sedimentation.

4.3 Storage and refueling facilities for fuels, oil, and other hazardous materials shall be sited within secured areas on impermeable surfaces at least 300 m away from water bodies, and provided with bunds and cleanup kits. If refueling in the field is required, it shall be done from road-licensed fuel trucks away from watercourses or other environmentally sensitive areas.

4.4 Material stockpiles shall be protected against wind and runoff water which might transport them to surface waters. There shall be no storage of materials and equipment in or close to water bodies.

4.5 Any chemical spills into drains and water bodies shall be cleaned up within 24 hours of the occurrence, with contaminated soils and water treated according to *Technical guidelines for site soil remediation* (HJ 25.4-2014). Records must be handed over without delay to the Project Management Office and the local Environmental Protection Bureau.

5. Protection of biological resources and wildlife

5.1 Construction workers are prohibited from capturing any wildlife during construction.

5.2 Existing trees and grassland shall be protected during construction. Trees or shrubs shall be removed only as the last resort if they impinge directly on the permanent works or necessary temporary works.

5.3 Where a tree has to be removed or an area of grassland disturbed, trees shall be replanted and the area revegetated after construction.

6. Solid waste management

6.1 The re-use of construction waste on the project shall be maximized.

6.2 Borrow area and spoil disposal site for station construction shall be located at least 300 m from residential areas so as to reduce potential dust and noise impacts from these sites.

6.3 Spent borrow area and spoil disposal site shall be rehabilitated and vegetated within one month after closure to prevent soil erosion and dust generation.

6.4 All refuse and construction waste generated on construction sites shall be stored in designated areas and regularly removed from these locations for disposal or reuse.

7. Prevention of soil erosion

7.1 Soil erosion prevention measures shall be installed and implemented in all construction sites, construction staging areas, borrow areas and spoil disposal sites in accordance with requirements in the approved revised environmental impact report.

7.2 The Contractor shall pay close attention to drainage provision and establishment of vegetation cover on backfilled areas to prevent soil erosion.

7.3 If restoration is carried out during periods of hot or extreme weather, ensure adequate aftercare to maximize survival of vegetation.

8. Construction site sanitation

8.1 Adequate and functional systems for sanitary conditions, toilet facilities, waste management, labor dormitories and cooking facilities shall be provided.

8.2 The site shall be effectively cleaned and disinfected. During site formation, the site shall be sprayed with phenolated water for disinfection. Toilets and refuse bins shall be disinfected and timely removal of solid waste shall be ensured.

8.3 Rodents on site shall be exterminated at least once every 3 months. Mosquitoes and flies shall be exterminated at least twice each year.

8.4 Public toilets shall be provided in accordance with the requirements of labor management and sanitation departments in the living areas on construction site, and designated staff responsible for cleaning and disinfection shall be appointed.

8.5 Construction site domestic wastewater shall be discharged into the municipal sewer system or treated on-site using portable systems or septic tanks.

9. Occupational safety

9.1 At least one environment, health and safety (EHS) officer shall be appointed to manage occupational health and safety risks on construction sites.

9.2 Personal protective equipment (PPE) (such as safety hats and shoes, high visibility vests, and safety belt and harness for above ground works) shall be provided to all construction workers. The use of PPE by all workers shall be strictly enforced.

9.3 Safety goggles, gloves and respiratory masks shall be provided to workers doing interior fit-out works.

9.4 Ear plugs for hearing protection shall be provided to workers operating and working near noisy power mechanical equipment.

10. Food safety

10.1 Food hygiene in canteens on site shall be inspected and supervised regularly. Canteen workers must have valid health permits.

10.2 If food poisoning is discovered, effective control measures shall be implemented immediately to prevent it from spreading.

11. Disease prevention and health services

11.1 All construction workers shall undergo a physical examination before starting work on site. If infectious disease is found, the patient must be isolated for treatment to prevent the disease from spreading. Physical examination shall be conducted on 20% of the workers every year from the second year onwards.

11.2 Health clinic shall be established at location where workers are concentrated, which shall be equipped with common medical supplies and medication for simple treatment and emergency treatment for accidents.

11.3 Induction and training by local health departments on prevention and management of communicable diseases shall be provided.

12. Community health and safety

12.1 A traffic control and operation plan shall be prepared together with the local traffic police prior to any construction. The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.

12.2 Construction billboards, which include construction description, schedule, responsible person and complaint phone number, shall be erected at the entry to each construction site and construction staging area.

12.3 Residents and businesses shall be informed in advance of noisy construction activities such as piling, given the dates and duration of expected disruption and made aware of the project grievance redress mechanism.

12.4 Clear signs shall be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations, etc. and raising awareness on safety issues.

12.5 All construction sites shall be made secure and access by members of the public shall be discouraged through appropriate fencing, signage and/or security personnel, as appropriate.

13. Utility interruption

13.1 Contractors shall assess construction locations in advance and identify potential for disruption to services and risks before starting construction. Any damage or hindrance/disadvantage to local businesses caused by the premature removal or insufficient replacement of public utilities shall be subject to full compensation, at the full liability of the contractor who causes the problem.

13.2 If temporary disruption is unavoidable the contractor shall, in collaboration with relevant local authorities such as power company, water supply company and communication company, develop a plan to minimize the disruption and communicate the dates and duration in advance to affected persons.

14. Grievance redress mechanism

14.1 The contractor's environment, health and safety (EHS) officer shall be responsible for managing the grievance redress mechanism (GRM) on site for receiving and handling complaints. In case of a complaint, the contractor shall notify the project management office within one week and shall advise on the agreed solution.

14.2 The contractor shall disclose the GRM to affected persons before construction begins at the main entrance to each construction site.

14.3 The contractor shall maintain and update a Complaint Register to document all complaints.

Climate Risk and Vulnerability Assessment

People's Republic of China: Multimodal Passenger Hub and Railway Maintenance

July 2018

Contents

I. Introduction

A. Background of the Project

1. This Climate Risk and Vulnerability Assessment is prepared for the proposed construction of the Xichang West Railway Station on the E'mei–Miyi section of the Chengkun Rail Line located in Sichuan Province in the People's Republic of China (PRC). The climate risk screening of the proposed project has been assessed as medium risk.

2. The Chengkun Rail Line connects Chengdu in Sichuan Province with Kunming in Yunnan Province, and is a key part of a regional corridor that will eventually extend to the countries in the Greater Mekong Subregion (GMS) to western PRC and the Eurasian land bridge. The existing line between Chengdu and Kunming was built between 1958 and 1970. It is a single track line with operating speed ranging from 40 km/h to 60 km/h. It has been operating at nearly full capacity for more than 10 years. The China Railway Corporation (CRC) is expanding the capacity of this railway line, involving construction of 860 km (645 km in Sichuan and 215 km in Yunnan) of double track electrified main railway line for passenger and freight transport. The proposed alignment of the new Chengkun Rail Line will be shortened by 236 km (21.5%) compared to the existing single track line (1,096 km) and has better geometry. Train speed on the new line would be increased to 160 km/h. The tonnage could increase from 3,200 t to 4,000 t net per train. The capacity of train–pairs per day would increase from 43 to 180. The shorter alignment and faster train speed would decrease the travel time from Chengdu to Kunming to less than 8 hours for passenger trains compared to the present 18–22 hours.

3. The E'mei–Miyi Line is the middle section of the Chengkun Rail Line. The existing E'mei–Miyi section has a total length of 535 km, with 61 stations and approximately 12 passenger trains and 23 cargo trains each way per day. The proposed capacity enhancement of the E'mei–Miyi section totals 392 km (consisting of 386 km main line and 6 km branch line) and includes the re-construction of 2 existing stations and construction of 16 new stations, with 149 bridges and 53 tunnels. Capacity enhancement of the main line consists of construction of a second track totaling 5.5 km from E'mei to Yangang (total two tracks) and construction of two new tracks totaling 378 km from Yangang to Miyi (total three tracks). The operational intent is to use the existing track for a few slow passenger trains and freight trains, and the new tracks for fast passenger and freight trains.

4. The **impact** of the project is development of sustainable railway system in southwestern PRC. The **outcome** of the project is development of integrated, energy efficient and sustainable railway corridor in Sichuan province. The project will deliver three **outputs**.

5. **Output 1: Multimodal Hub developed.** This project will construct a multimodal passenger hub in Xichang (Xichang West Station) which is a growing tourist destination in Sichuan province. Xichang City is the capital of Liangshan Prefecture in Sichuan Province, located in the middle of the CKRL. The hub will include good intermodal connectivity and energy efficiency features in the form of improved insulation and enhanced air ventilation systems and conform to PRC's standard for green buildings. It will have provision for renewable energy generation through solar PV. The hub will incorporate a bus station for long distance, local and tourist buses; ticketing and support facilities; parking for cars, motorcycles, bicycles and pedestrian walkways linking the railway station to the other transport modes to facilitate intermodal transfers.

6. **Output 2: Railway maintenance improved.** Track renewal and track laying operations require high expenditure for personnel and machines. With the help of mechanized work methods these costs can be significantly reduced and a higher quality can be achieved. This output will procure modern railway track maintenance machines. The equipment will cover track inspection and repair as well as rescue and restoration equipment.

7. This output will also include capacity building for railway maintenance measures and training on railway maintenance systems. Working with the executing agency (EA), the design institutes, and the railway administrations, the existing institutional arrangements for railway maintenance will be reviewed, and recommendations made to make these more mechanized, efficient and reliable. Staff from pertinent government agencies will receive training on maintenance systems to better equip them to improve the quality of maintenance. About 100 staff from executing and implementing agencies will be trained, and technical exchanges on maintenance technologies and new maintenance techniques will be organized to familiarize staff in these areas. Training on the operations of the new railway maintenance machines will be included in the procurement contracts. ADB will also provide railway asset management training through its Knowledge and Support Technical Assistance on Sustainable Transport.

8. The **Xichang West Station** (see the figure 1) will be built in a newly urbanized area of Xichang City, about 10 km west of the existing city center and 13 km southwest of the Xichang Qingshan Airport.

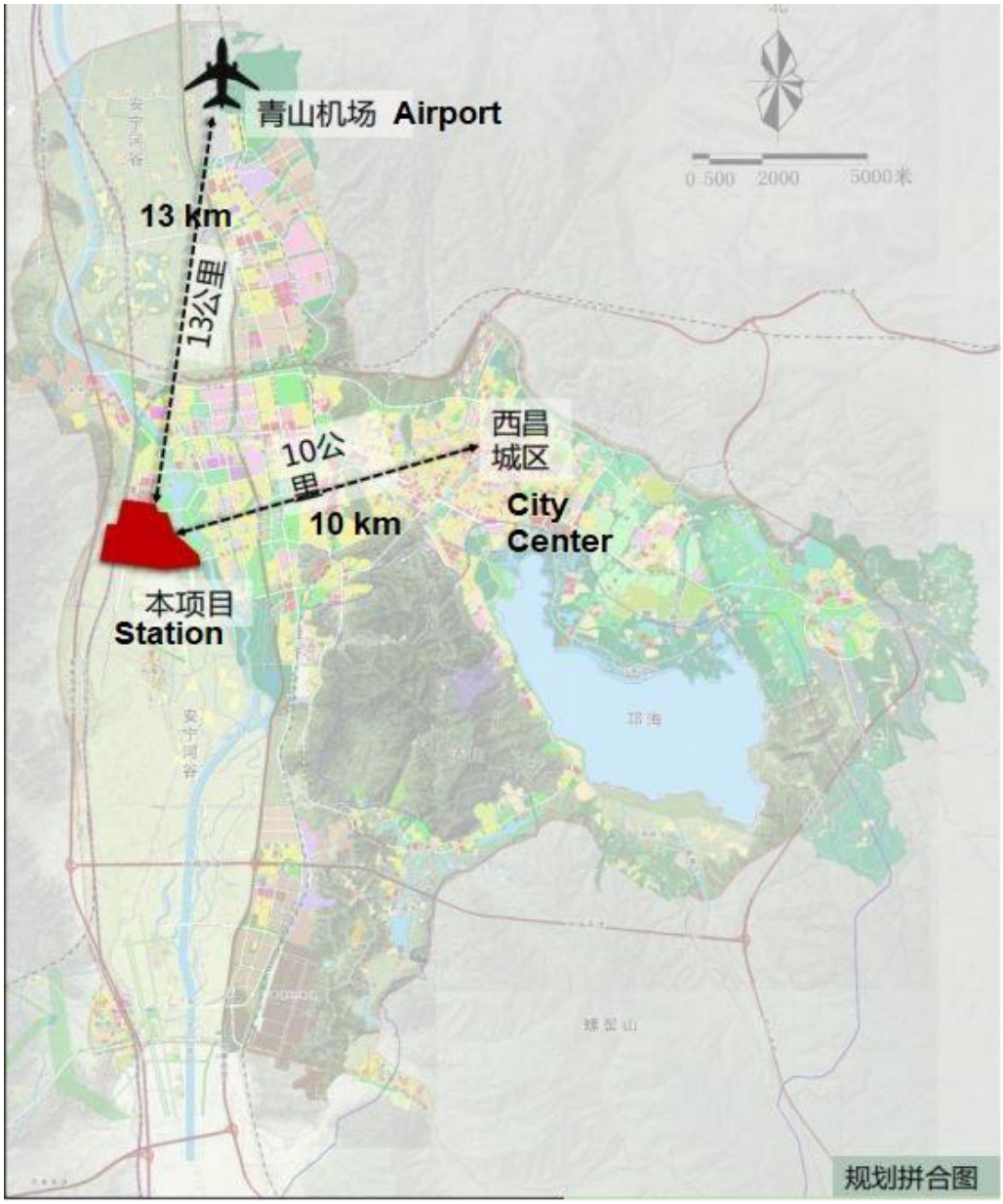


Figure 1 Project Location

9. The Xichang West Station will have a building area of 15,000 square meter (m^2). The railway station and other transport modes will be kept in seamless connection for convenience in interconnectivity. The eastern square of the station will be used as a transfer interchange center for railway station and related other transport facilities, including city bus, taxi and long distance coach terminals.

10. The Xichang Station is located at 102.22 degree east longitude and 27.85 degree north latitude. The climate is subtropical monsoon climate and is fairly mild in winter and rather cool in summer. This area is rich in light and heat resources. The year-round duration of sunshine lasts 2432 hours. Frost-free time is 273 days in a year. Annual average temperature is 17.1°C. The average annual rainfall is 1087.5 mm while more than 90% of the total precipitation mainly occurs in June to November. The characteristics of local metrological conditions are shown in Table 1.

Table 1 Local Metrological Parameters of Xichang[1]

Parameter	Sub-category	Value
Temperature	Average:	17.1℃
	Highest daily temperature:	39.1℃
	Lowest daily temperature:	-3.8℃
Precipitation	Average daily precipitation:	2.8mm
	Maximum daily precipitation:	135.7mm
Average Humidity		50%
Average Pressure		837.7hPa
Average Wind Speed		1.4m/s
Average Hours of Sunshine		6.4 hours

II. CRVA Methodology

11. Data from The Coupled Model Inter-comparison Project Phase 5 (CMIP5) climate models were compiled and reviewed for the Xichang West Station. The downscaled climate scenarios that are derived from the General Circulation Model (GCM) runs conducted under the CMIP5 were established for Xichang City. The assessment was conducted for different greenhouse gas emissions scenarios known as Representative Concentration Pathways (RCPs) developed for the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5).

12. The CMIP5 climate projections were obtained through model simulations for four different scenarios, RCP2.6, RCP4.5, RCP6.0, and RCP8.5, which represent different levels of greenhouse gas emission. Among them, RCP2.6 is considered as the scenario with the lowest emission that corresponds to the agreed outcomes of the Paris agreement (no more than 2.0°C over pre-industrial). RCP4.5 and RCP6.0 are the medium and high scenarios but their differences are mainly in late of this century with little difference by 2050. RCP8.5 is the extreme case that represent the highest level of emission with the most significant climate changes.

13. A conservative approach was adopted to use RCP4.5 as a reference scenario and RCP8.5 as a challenging scenario for this CRVA analysis. Future climate hazards, such as floods,

[1] The source of data is from the China meteorological database.

water resources, and temperature extremes, etc. were derived by analyzing these two scenarios at a regional scale. This is to ensure that both risk assessments and proofing measures derived from this analysis are adequate for the proposed project component- mainly the Xichang West Station.

14. The General Circulation Model (GCM) data used in this study include both the historical baseline (1961 to 2005) and projected future climate change scenarios of both the RCP 4.5 and RCP 8.5 (2006 to 2100) scenarios. The climate sensitivity resulted from a comprehensive scientific modelling results was introduced to produce a possible uncertainty range.

15. The output of precipitation and temperature data from the GCMs was applied in the CRVA to project future climate change conditions. Simulated precipitation/temperature data were obtained for the following three climate change scenarios: Historical, RCP 4.5 and RCP 8.5 as shown in Table 2.

Table 2 Summary of Climate Change Data/Scenario for the CRVA

Climate Projection	Representative Concentration Pathways	Climate Sensitivity	Variable	Data Series
Historical Scenario	Historical data	-	Daily Precipitation, Daily Maximum Near-Surface Air Temperature, Daily Minimum Near-Surface Air Temperature	1950-2005
Low Scenario	RCP4.5	Low	Daily Precipitation, Daily Maximum Near-Surface Air Temperature, Daily Minimum Near-Surface Air Temperature	2006-2100
High Scenario	RCP8.5	High	Daily Precipitation, Daily Maximum Near-Surface Air Temperature, Daily Minimum Near-Surface Air Temperature	2006-2100

16. Three key periods timeframes were defined for the CRVA: 1) PA, the past 26 years from 1980 to 2005; 2) NF, the near-term future from 2025 to 2050; and 3) LF, the long-term future from 2075 to 2100.

17. For this CRVA, the dataset of Xichang will be adopted. The method described above was adopted to generate the climate change projections for climate variables (such as maximum temperature, minimum temperature and precipitation) that may cause hazardous to the proposed project in Xichang. Table 3 lists the specific information on the Xichang meteorological station.

Table 3 Meteorological Station Data

Station Name	Longitude (°)	Latitude (°)	Historical period
Xichang	102.22	27.85	1950-2005

III. Historical Climate Data and Climate Change Projections

A. Historical Temperature Data and Their Future Projections

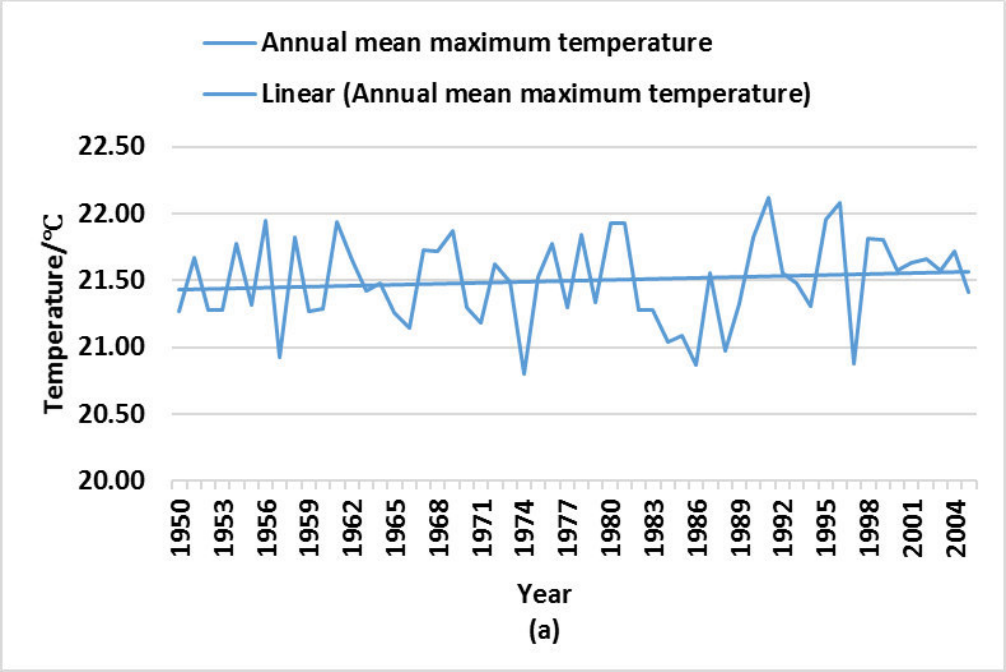
18. The Xichang train station is located in a sub-tropic monsoon climate zone. The climate change will very likely cause temperature to increase in the project area. The annual average maximum temperature at the project site has gradually been increasing since 1950. The observed annual mean maximum and minimum temperatures are 32.21°C and -6.89℃ respectively, during the period from 1950 and 2005, while the GMC predicted data are within the range of 32℃ to 38.57℃ and -5.83℃ to -6.07℃ under the low and high scenarios, respectively.

19. The annual mean maximum and minimum temperatures are projected to likely have a small change in the future. Figure 2(a) shows the historical annual maximum temperatures and trend line during 1950 and 2005 while Figure 2 (b) shows the minimum temperatures. It is obvious that the historical annual minimum temperature has a tendency of rise from 1950 to 2005.

20. Figure 3 shows the projections of the future average maximum and minimum temperatures and their trend lines from 2006 and 2100. The figures show that the temperature at the Xichang area is projected to rise in the future.

21. **Error! Reference source not found.**Table 4 shows the average maximum and minimum temperatures and their differences from the baseline. The annual average maximum temperature is projected to increase by 1.49°C and 1.91°C under the low and high scenarios, respectively, in a near-term future and by 2.63°C to 4.62°C in the long-term future. The annual average minimum temperature will increase by 1.39°C to 1.66°C under low and high scenarios in the near-term future, and by 2.33°C to 4.29°C in the long-term future.

22. Overall, the temperature of the project area is predicted to be gently increased in the future.



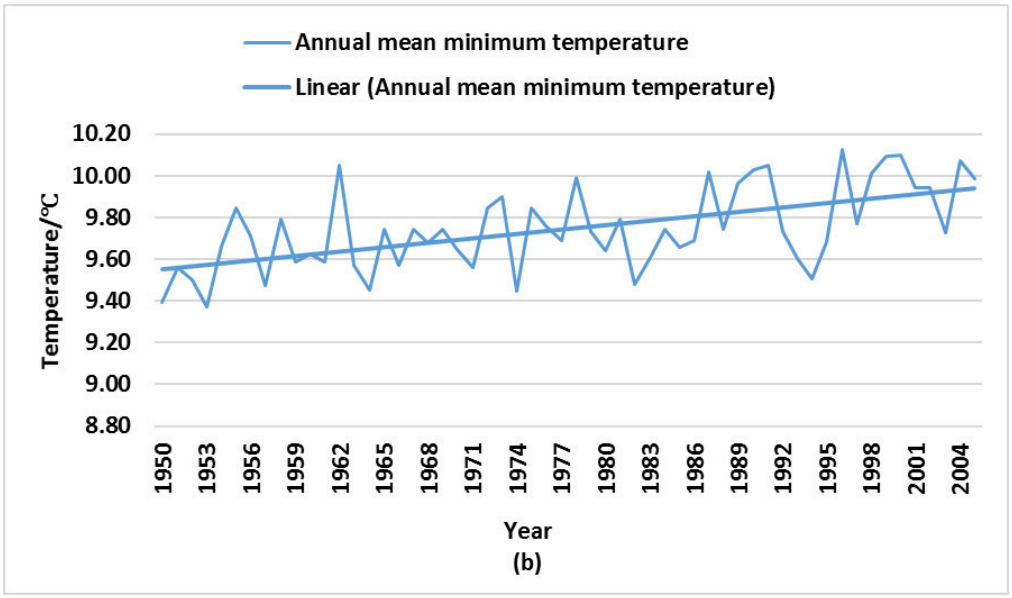
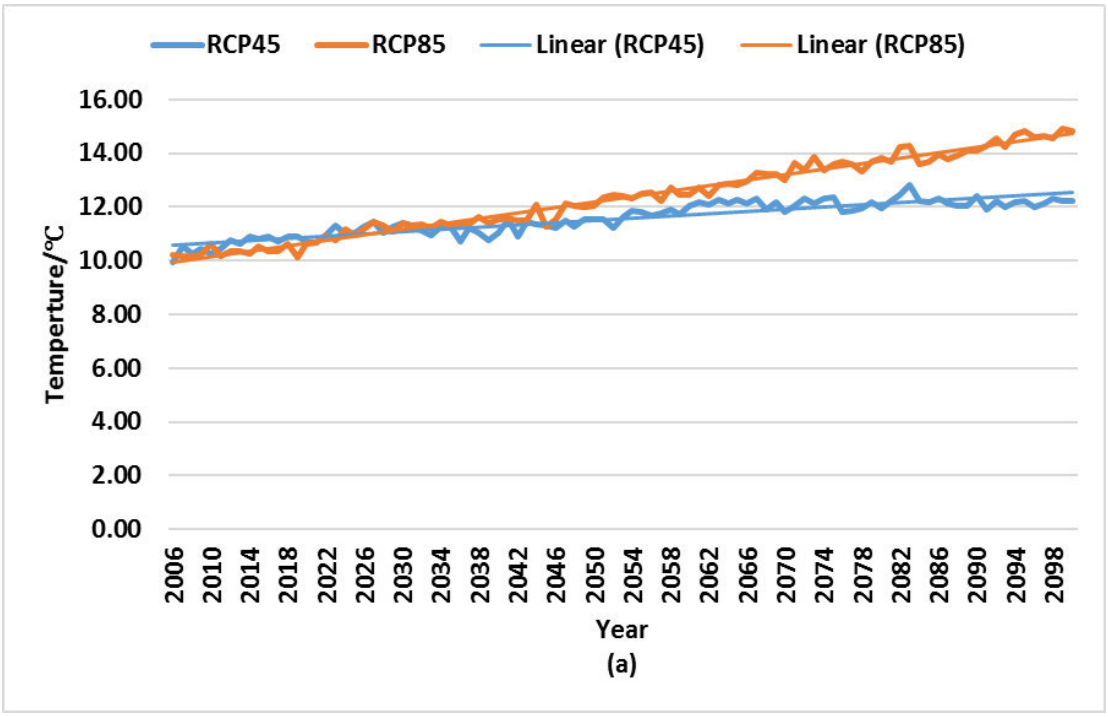


Figure 2 Xichang (a) Annual Average Maximum Temperature and Its Tendency Line; (b) Annual Average Minimum Temperature and Its Tendency Line



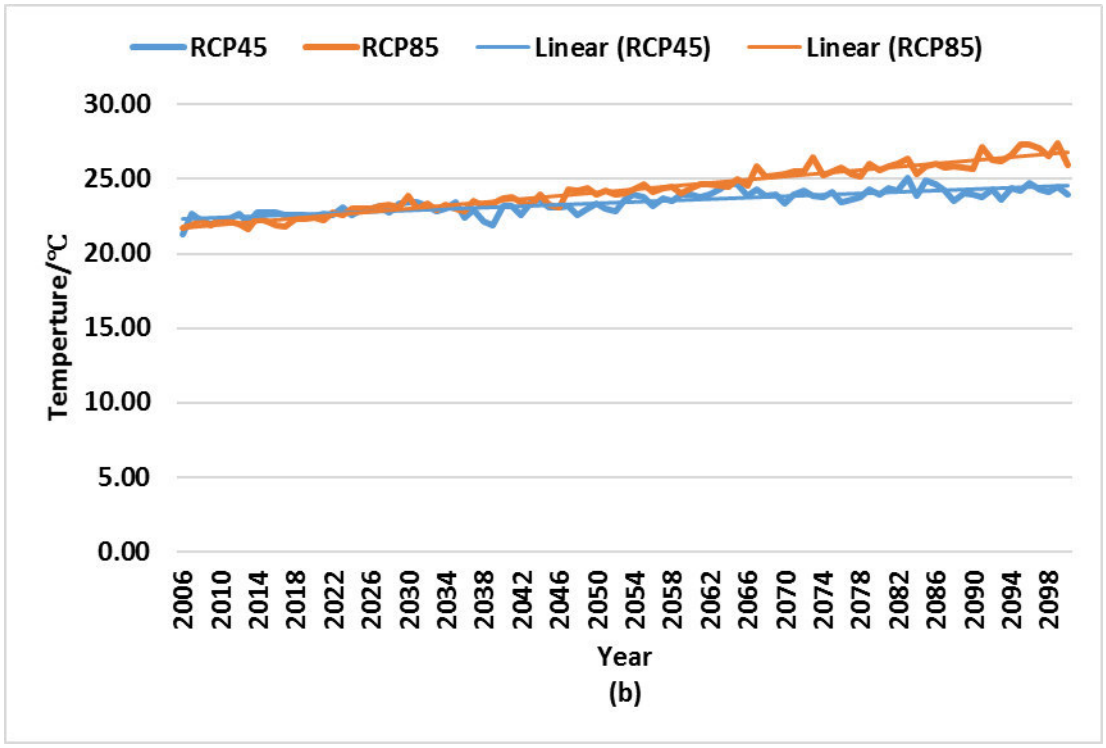


Figure 3 Xichang (a) Future Projection of Annual Minimum Temperature and Its Tendency Line (2006-2100); (b) Future Projection of Annual Maximum Temperature and Its Tendency Line (2006-2100)

Table 4 Average Maximum and Minimum Temperature Change

#	Historical	RCP4.5		RCP8.5	
	Past years	Near-term	Long-term	Near-term	Long-term
	PA	NF	LF	NF	LF
	1980-2005	2025-2050	2075-2100	2025-2050	2075-2100
TMAX/℃	21.52	23.01	24.15	23.43	26.14
Change /℃	-	1.49	2.63	1.91	4.62
TMIN/℃	9.83	11.22	12.17	11.50	14.12
Change /℃	-	1.39	2.33	1.66	4.29

B. Historical Rainfall Data and Their Future Projections

23. The precipitation in Xichang is characterized by relative high inter-annual variability and seasonality. Figure 4 shows the historical annual precipitation and trend line during 1950 and 2005. There is no obvious change in the annual precipitation during this period. The annual average rainfall of Xichang was calculated to be 955.19mm with a coefficient of variation (Cv) of 0.16. The annual maximum rainfall is 1308.66mm in 1964, while the minimum is 668.78mm in 1981.

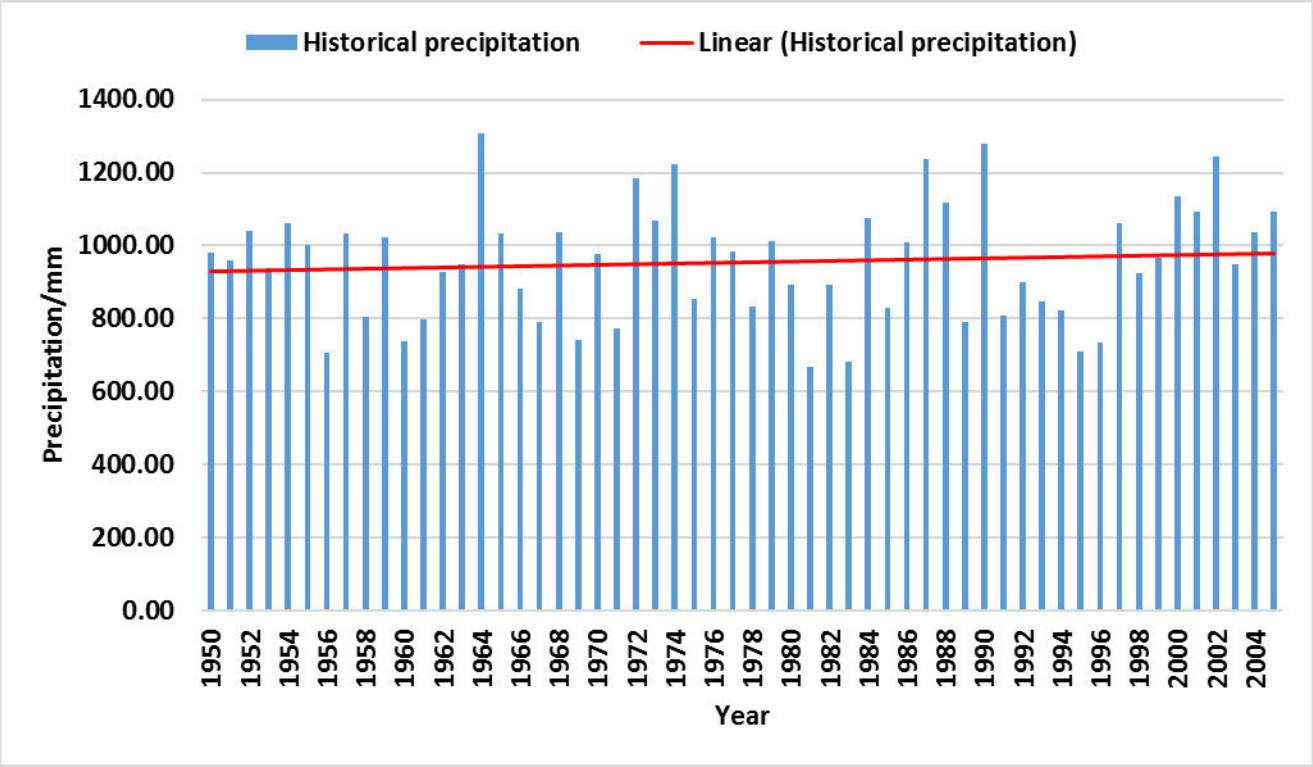


Figure 4 Xichang Historical Annual Precipitation and Tendency During 1950 and 2005

24. Figure 5 shows the projected variation of annual precipitation under the low and high scenarios during 2006 and 2100. The annual average precipitation increases by 0.1% to 1.4% under the low and high scenarios, respectively, when compared to the historical annual average precipitation of 955.19mm. By analyzing the annual average rainfall during the wet season from April to October (7 months), the annual average precipitation during the wet season increases by 0.1% to 1.2% compared with historical wet-season data.

25. Overall, the total amount of rainfall is projected to increase slight over a long term in the future in the project area. The climate change will possibly lead to a slight rainfall increase in the project area.

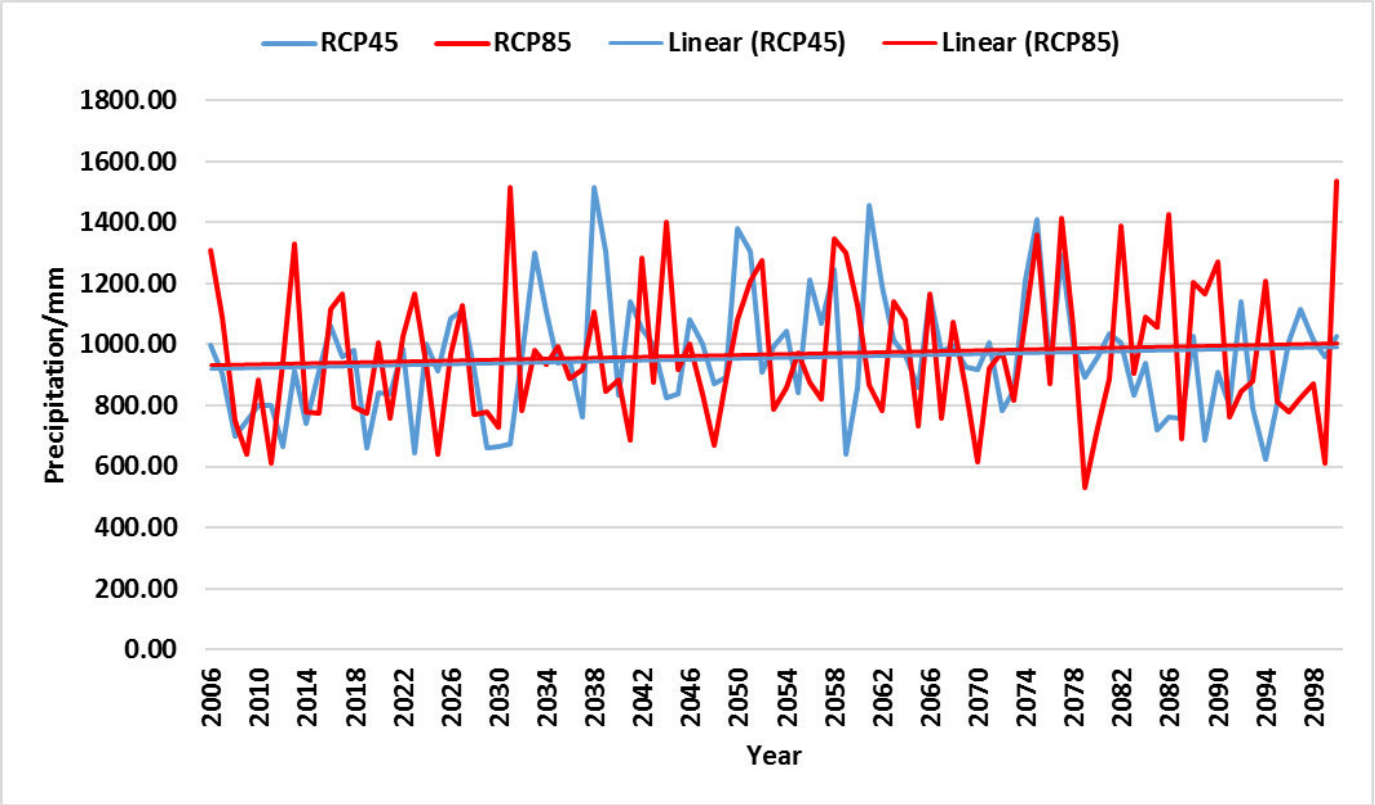


Figure 5 Projection of Annual Precipitation in Xichang Under Low and High Scenarios During 2006 and 2100.

26. The projected annual average precipitation for Xichang is shown in Table 5 for the NF and LF timeframes. The average precipitation is projected to increase by 3.9% in the near-term future and decrease by 1.4% in the long-term future under the low scenario. Under the high scenario, it is projected to decrease by 1.2% and increase by 5.6% in the near future and long-term future, respectively. The results show that the future multi-year annual average precipitation will remain overall steady under the low scenario and high scenario.

Table 5 Multi-Year Average Annual Precipitation

#	Baseline	RCP4.5		RCP8.5	
	Past years	Near-term	Long-term	Near-term	Long-term
	PA	NF	LF	NF	LF
	1980-2005	2025-2050	2075-2100	2025-2050	2075-2100
Precipitation /mm	953.88	991.46	940.53	942.04	1007.26
Change/%	-	3.90%	-1.40%	-1.20%	5.60%

27. Figure 6 shows the projected monthly precipitation in Xichang for different timeframes under the low and high scenarios. Under the low scenario, monthly rainfall is projected to decrease in August and October in the future and increase in other months. Under the high scenario, rainfall will decrease in August in the future and increase in other months. The rainfall is mainly concentrated in the period from June to September.

28. Figure 7 shows the annual monthly precipitation during June and September for the years from 1980 and 2100 (covering PA, NF, and LF) under the Low Scenario (a) and High Scenario (b). It shows that the average monthly precipitation during June and September does not show significant changes for the period from 1980 to 2100.

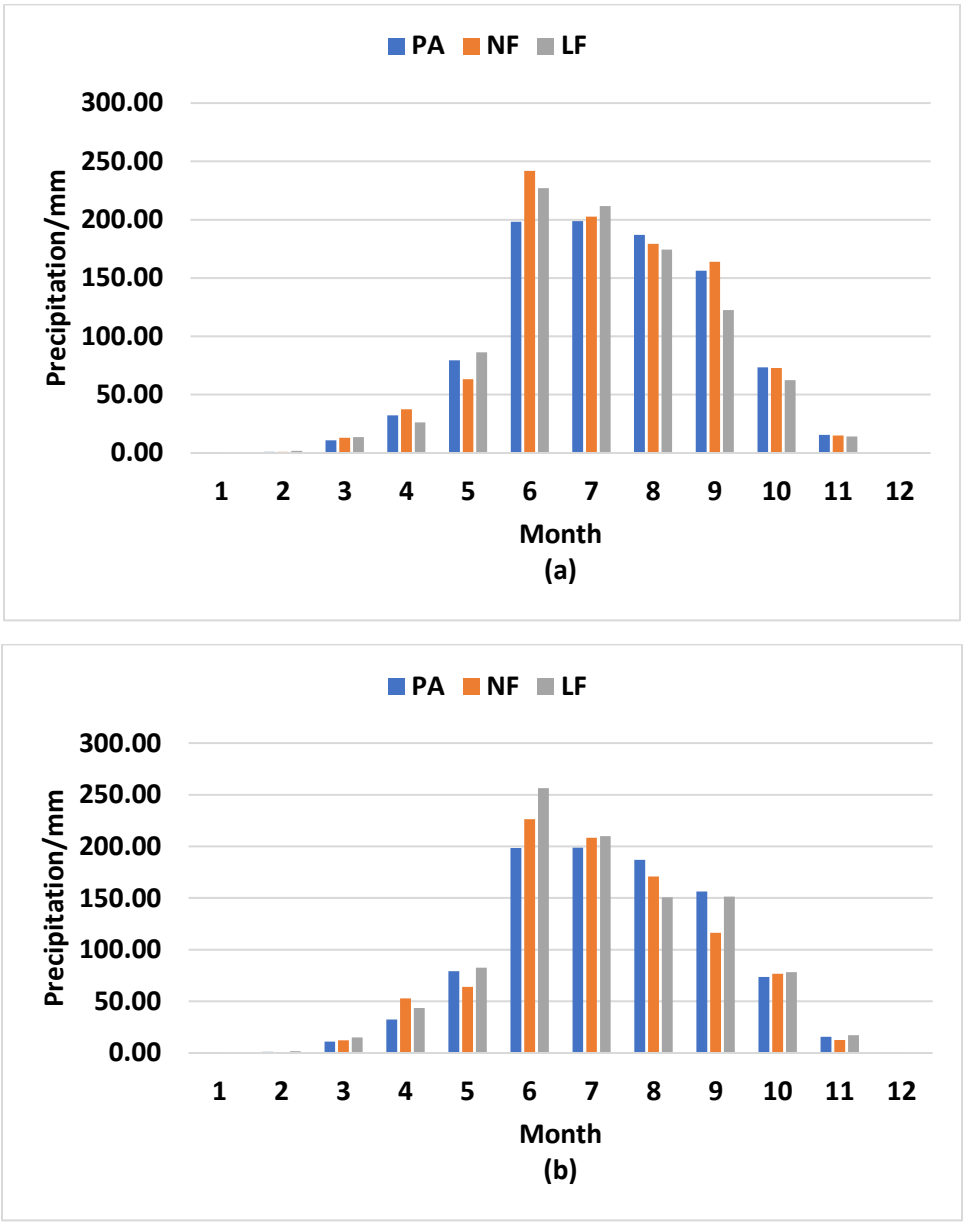


Figure 6 Projected Monthly Precipitation in Xichang Under Low Scenario (a) and High Scenario (b)

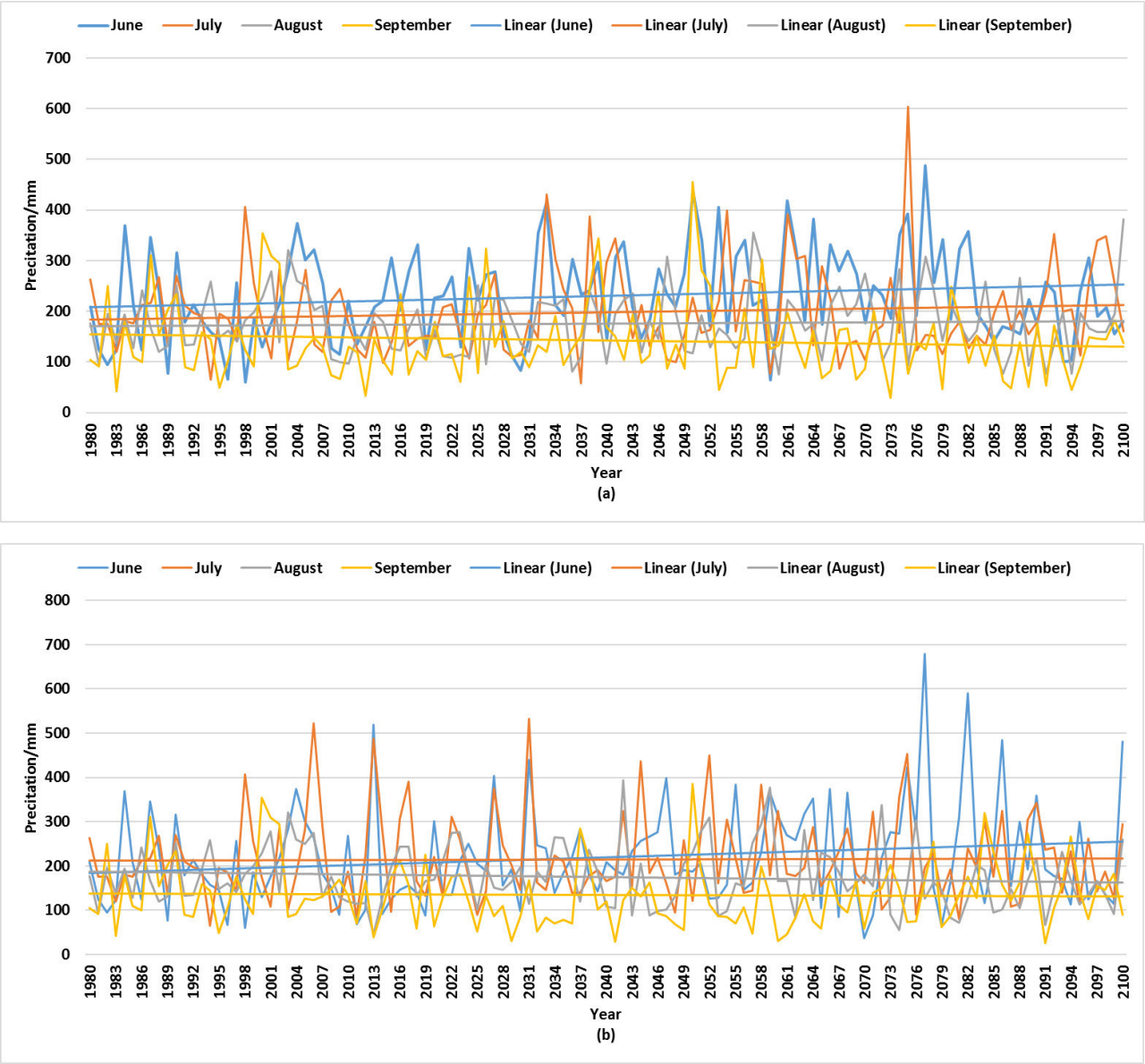


Figure 7 Annual Monthly Precipitation During June and September and Its Projection Under Low Scenario (a) and High Scenario (b)

C. Extreme Rainfall and Its Projection

29. The projected results as described above indicate that the precipitation is likely to have a greater change under the high scenario (RCP8.5) than under the low scenario (RCP4.5). The projected rainfall data for the high-scenario were therefore compared with historical dataset to assess the impact of climate change under the extreme conditions. As shown in Table 6, in the near-term future, there is an obvious increase in the maximum daily rainfall by 16% for a 5-year return interval and 23% for a 100-year return interval compared to the baseline conditions. On the other hand, in the long-term future, the maximum daily rainfall is projected to increase by 11% for a 5-year return interval and 4% for a 10-year return interval, respectively, and decrease gradually by 2% to 12% when the return interval is greater than 10-year.

30. In summary, the impact of climate change will possibly result in an increase in rainfall amount and rainfall intensity in the project area of Xichang. Although the increase in the total amount of annual precipitation may be minor, the increase to the rainfall intensity could be significant, especially to the rainfall intensity of storm events of 30-, 50- and 100-year return intervals under the near-term timeframe. This implies that the flood risk in the project areas could be increased in the future in the project area, especially in the near-term future.

Table 6 Projected Maximum Daily Rainfall with Different Recurrence Intervals

Return period(year)	Baseline	RCP8.5	
	Past years (1980-2005)	Near-term (2025-2050)	Long-term (2075-2100)
	PA	NF	LF
5	72.44	83.89	80.62
10	88.95	105.85	92.58
20	105.01	126.91	102.96
30	114.26	138.96	108.54
50	125.81	153.91	115.19
100	141.32	173.89	123.68
Change over the Baseline（%）			
5	--	16%	11%
10	--	19%	4%
20	--	21%	-2%
30	--	22%	-5%
50	--	22%	-8%
100	--	23%	-12%

IV. Climate Change Impact on the Project and Implications on Project Design

31. The results of climate change analysis indicate that the project areas are likely to experience higher temperatures in the future due to the impact of climate change. This may be beneficial to the transport systems because of the reduced frequency of foggy and frost weather conditions, hence resulting in a reduction in the risk of stoppage and damage to the transportation systems. On the other hand, the increase in temperature may result in intensified heat waves that may damage the road surfaces. Nonetheless, with a projected increase of temperature by 4.6°C

by 2100 under the high scenario, the highest temperature will still be under 39°C in the project area of Xichang. This indicates that the increase in temperature due to climate change is not expected to have significant effects on the pertinent project components of Xichang West Station.

32. As for precipitation and rainfall intensity, the impact is much more significant on the intensity of heavy rainfall and storm events than on overall total amount of precipitation. The increased rainfall intensity of storm events may result in higher flood peak flows and impose higher flooding risks to the project components. Therefore, the impact of climate change on extreme rainfall events should be factored into the design of railway engineering works of the Project.

V. Adaption to Climate Change

33. As discussed previously, increased intensity of extreme rainfall and associated flood events is the most relevant climate risk to the Project. To avoid costly maintenance and/or business disruption in the future, the Project should consider additional flood risks induced by the climate change impact in designing the project engineering works. Measures for adaptation to the climate change should also be developed in project construction and operation.

VI. Conclusions and Recommendations

34. The highest risk that climate change may impose to the Project in Xichang is flood peak flows as a result of increased intensity of storm events.

35. The development of detailed adaptation measures to climate change requires a detailed analysis of climate change impact at the project sites. This may require the development of hydrological models.