CLIMATE CHANGE ASSESSMENT (SUMMARY)

I. Basic Project Information

Project Title: Chongqing Longxi River Basin Integrated Flood and Environmental Risk Management Project

Project Budget: $150.0 million

Location: Chongqing Municipality, People's Republic of China

Sector: Agriculture, natural resources and rural development; water and other urban infrastructure and services

Themes: rural flood protection, water based-natural resources management, urban flood protection, urban sanitation, and urban solid waste management

Climate Risk Level: Medium

Brief Description *(particularly highlighting aspects of the project that could be affected by weather/climate conditions)*:

Chongqing Municipality, along the Yangtze River Basin, is one of the four centrally-administered municipalities in the People's Republic of China. It is the country's first provincial demonstration area to pilot urban–rural reforms. The government also considers the municipality as a national hub and demonstration of the Belt and Road and the Yangtze River Economic Belt (YREB) initiatives. Despite its strategic importance and annual growth of over 10%, the challenges of urban–rural income disparities are still high in the municipality. In 2016, the ratio of the urban–rural average income was 2.6:1. About 200,000 rural residents in the municipality are still below the designated poverty line of CNY3,100 per annum. Many of its rural towns and villages are left behind from their overall development because of insufficient public services and infrastructure, continued flood disasters, and environmental degradation. To rebalance development, the municipality will support different levels of cities, towns, and villages to enhance living environments, physical connectivity, and economic competitiveness. To be a successful model, the municipality needs to mainstream flood and environmental risk management (FERM) into development practices not only to safeguard development but also to alleviate the risks in the locality through better planning and designing of infrastructure leading to an improved quality of life.

Chongqing Municipality suffers from different types of floods annually and was hardest hit in 2007, 2010, 2013, 2014, and 2016. One of the worst flood affected areas in the municipality is the Longxi River, a first-class tributary of Yangtze River.[a] The entire Longxi River Basin with a size of 2,966 square kilometers (km^2) (230 kilometers in length) lies in the municipality. The river originates in Liangping District, passes through Dianjiang County, and merges into the Yangtze River in Changshou District. The flood plains of Longxi River with a current population of 2.1 million, represents the model Longxi River Economic Belt Initiative (a sub-basin version of greater YREB) of the municipality. The most recent flood in 2016 in the basin resulted in seven human deaths, 50,000 evacuated, and $0.3 trillion direct economic damage. The flood formed several belts of floating rubbish in the municipality, which exacerbated flooding and water pollution. The water quality in the Longxi River is lower than the third-tier national standards resulting from both point (industrial and household wastes) and nonpoint (agriculture) pollution. About 40% of the residents in the basin do not have access to modern solid waste and wastewater facilities. There are over 10 km^2 of active fish ponds along the river corridors, which discharge polluted water directly into the river. The water quality in the Changshou Lake (65 km^2) in Longxi River, has deteriorated along with eutrophication due to untreated waste disposal. Sediment yield due to river bank erosion and a large number of landslides, as well as mining activities in upstream areas has resulted in reduced river conveyance, exacerbated flooding, reservoir shrinkage, and water contamination by heavy-metals. The climate change impact in the basin is likely to worsen the water quality due to decreased annual river flow, and to increase floods due to increased rainfall intensity with return period of 50-year into 10-year towards 2050. The Chongqing Municipal Government (CMG) is finalizing a long-term Longxi River Ecological and Restoration Implementation Plan 2030. Other sectoral plans, including the Environmental Protection Plan, Water Pollution Control Action Plan, Ecological Conservation Plan, and five-year plan (2016–2020) aligned with the Thirteenth Five-Year National Plan (2016–2020) have been prepared. The CMG is prioritizing its efforts on FERM and seeking supports from the Asian Development Bank to help effectively address the challenges. The project aims to demonstrate an integrated and nexus approach for inextricably intertwined

FERM by applying both structural and nonstructural measures in the Longxi River Basin as a whole and considering urban–rural and upstream–downstream linkages in project planning. The project will help the municipality formulate a comprehensive FERM plan in Longxi River Basin and contribute to the establishment of flood and environmental monitoring system, sub-regional data and information sharing platform, and flood footprint accountability system in the Longxi River Economic Belt and greater YREB. The project will have the following outputs:

Output 1: Flood risk management infrastructure constructed. This will implement (i) flood preventive measures, including constructing embankments and transforming small barrages to gated structures; (ii) water retention measures, including a temporary flood retention area and installing flood diversion structures; and (iii) flood preparedness measures, including constructing shelters and emergency access roads.

Output 2: Wastewater management and pollution control infrastructure developed. This will implement (i) a wastewater management system, including installing a wastewater collection network; and (ii) water pollution control measures, including constructing a bio-shield (greenbelts) along the riverbanks to tap leached sediment and nutrients from farmlands, and installing solid waste collection bins along the riverbanks.

Output 3: Ecological conservation facilities improved. This will implement (i) wetland conservation, including restoring wetlands in existing lakes and rivers; (ii) ecological restoration, including landscaping, greening, and gardening along the river and lakes corridors; and (iii) soil and water conservation, including riverbank protection and erosion control.

Output 4: Flood and environmental risk management capacity enhanced. This will include (i) hydro-meteorological services, including establishing a flood footprint and accountability mechanism, developing and installing a watershed simulation model, and establishing a river monitoring system; (ii) development planning and programming, including formulating a comprehensive FERM plan, drafting land use regulations, and formulating investment road maps in the watershed; and (iii) capacity development of local governments and communities, including climate-resilient community-based FERM that involves a flood early warning system and solid waste management, strengthening Longxi River coordination body in applying the river chief system, and updating reservoir operational guidelines.

[a] A smaller branching stream channel that flows directly into a main stream channel.

II. Summary of Climate Risk Screening and Assessment

Preliminary risk screening, conducted in accordance with the Asian Development Bank's climate change risk management framework, rated the project as "medium to high risk" for climate change impacts, triggering a requirement for a full "climate risk and vulnerability assessment". The summary of the climate risk and vulnerability assessment will be included in the report and recommendation of the President to the Board of Directors through the Climate Change Assessment linked document. Climate risks are mainly induced by projected high precipitation increases and floods, which may negatively impact location and project design; the location of environment rehabilitation and design of the fluvial defense infrastructure: this is mindful of floods and its underlying hydrological analysis informed by climate projections, i.e. the design standards and operational and maintenance standards were reviewed to take into consideration current impacts of heavy precipitation events as well as potential future changes.

Climate change risks were assessed for all project subcomponents based on the regional climate modelling outputs for 2040 (2021–2050) under the RCP4.5 and RCP8.5 climate change scenarios.

It is projected that annual average temperature will continue to increase, characterized by the increased probability of heat waves and decreased probability of cold events. Annual rainfall is projected to decrease slightly, and more months with decreased monthly precipitation can be found under RCP8.5. The decrease in precipitation especially autumn will cause drought. However, the frequency of the maximum daily rainfall of 100 and 50 years return period will be slightly increased, and the maximum daily rainfall of 20 years return period will have no clear changes in general. The projected storm will slight increase in general, and direction and magnitude of projected changes in storm will show spatially heterogeneous.

In the Longxi River Basin, climate risks are mainly induced by projected changes in precipitation, such as potential increase of drought in autumn and increase in 100-year and 50-year return period daily maximum rainfall. Projected temperature increases may stress physical structures, degrading materials (particularly plastic) and affect piping. Despite the uncertainties found in the projections by the climate change models, floods, severe storms, and droughts have historically had a high negative impact on the local economy, environment, and local quality of life.

(Further details are available in the Supplementary Document on Climate Risk Analysis.)

A. Climate risk screening

Risk screening for each major project subcomponents is presented in the following:

Flood risk management infrastructure construction: (i) flood preventive measures including construction of embankment, barrage renovation, and mainstreaming FERM in road planning and design; and (ii) water retention measures including temporary flood retention area, river banks landscaping, and dredging of river reaches.

The major climate risk to those proposed infrastructure is mainly induced by projected slight increase in precipitation intensity, especially for large magnitude (100-year and 50-year return period).

Wastewater management and pollution control infrastructure development: (i) wastewater management system including installation of wastewater collection network and improvement of existing wastewater treatment facilities; and (ii) solid waste management system including installation of garbage collection facilities and improvement of garbage transportation system.

The projected increase in storm will cause facilities and infrastructure (e.g., pump station) to be flooded and solid wastes will be directly rinsed out of rubbish bins by intense rain and floods. The projected temperature rise will affect buildings and facilities for sewage pipe network and will increase the microbial activity in solid wastes.

Ecological conservation facilities improvement: (i) wetland conservation including restoration of wetlands in existing lakes and expansion of wetlands in lakes and rivers; and (ii) watershed conservation including afforestation, water sources protection, farmland and farm waste management, lake and river banks protection, and lakeside greening and gardening in Shuanggui Lake.
The projected increase in temperatures and drought will change distribution patterns of pests and disease, and plants that are not adapted will be physiologically stressed.

Climate Risk Classification

Medium

B. Climate risk assessment

Project Subcomponent	Potential climate impact	Risk level
Flood risk management infrastructure construction	1) Runoff volume and flood peak will increase 2) River will drown dikes 3) Roads may be submerged	High
Wastewater management and pollution control infrastructure development	1) Surface runoff entering sewage pipes may increase 2) Facilities and infrastructure (e.g., pump station) may be flooded	Medium

	3) High temperature affects buildings and facilities (e.g., pump station) 4) Microbial activity will increase 5) Wastes will be directly rinsed out of rubbish bins by intense rain and floods	
Ecological conservation facilities improvement	1) Distribution patterns of pests and disease may change 2) Plants that are not adapted will be physiologically stressed	Medium

III. Climate Risk Management Response within the Project

Risk screening and adaptation measures for each major project subcomponents are presented in the following.

Flood risk management infrastructure construction: (i) the material selection of dikes will be based on estimated climate change impacts and risks; (ii) in the design of river embankment, the potential alteration of recurrence intervals for floods and torrents due to the increasing intensity of storm events was considered; (iii) the existing plans will have to be updated to increase capacity to respond to flood disasters and prepare for recovery; and (iv) awareness raising, capacity building, and knowledge development for locals citizens and local officials will be included in the capacity building.

The adaptation options considered in the project design and represented in the current feasibility study report include: (i) the sloping ecological embankment is designed for river embankment with more resistance to extreme climate events; (ii) water level monitoring system are designed for river involved in the project, and the frequency for water level observation will be monthly as normal and daily during flooding season; (iii) the existing plans have been updated to increase capacity to respond to flood disasters and prepare for recovery; and (iv) the increase in water levels along the river ranged from 0.0 m to 0.23 meter, and the top of riverbank are designed for the same increase.

Wastewater management and pollution control infrastructure development: (i) selection of materials, instruments, wastewater pipes, and the site should be based on estimated climate change impacts and avoiding flood risks; (ii) development of more distributed treatment system to reduce requirements for pumping; (iii) appropriate foundation protection and compaction should be adopted to avoid network system damage due to flooding and ground subsidence; and (iv) risky assets should be protected, replaced or moved in emergency, such as electricity supply and acquisition.

The construction of solid waste collection and transportation systems will include: (i) selection of rubbish container material and equipment based on estimated climate change impacts and risks, e.g. they should be able to withstand prolonged high temperatures; (ii) solid waste collection stations and resting area for workers are in a safe place (e.g., elevated) to avoid possible pollution caused by heavy precipitation and floods; (iii) selection of appropriate materials and protection measures to avoid impacts of solid waste collection facilities and solid waste storage due to high temperatures and extreme weather conditions; and (iv) the solid waste transportation facilities must be in a safe place (as defined by an analysis of topography and flood hazard maps) to avoid possible asset loss or to be out-of-service due to floods.

Ecological conservation facilities improvement: All species are Chinese native species and climate resilient: all planting materials (seeds, seedlings, saplings, and cuttings) come from the municipality or in the country; and can endure high temperature and periodic waterlogging and drought.

IV. Climate Mitigation within the Project

Many of the project sub-components will contribute to climate mitigation while addressing adaptation issues. This is the case for revegetation subcomponents of the project, i.e., establishment of ecological forest, river protection belt, and ecological grass belt, which will contribute to greenhouse gas emission reduction by sequestering over 694 tons of carbon dioxide equivalent per year.

V. Climate Finance within the Project

The climate vulnerability assessment and management report was conducted with the Climate Change Fund. The total climate finance of this project is $15.88 million (details of the climate finance are available in the Supplementary Document on Climate Risk Analysis).

All activities under the flood risk management infrastructure construction subcomponents adaptation measures aimed at reducing floods that are exacerbated by climate change, are estimated at about $0.18 million.

Selecting climate-resilient materials in the wastewater collection systems under wastewater management and pollution control infrastructure developed subcomponent aimed at increasing the resistance to climate change are estimated at about $2.3 million.

All activities under ecological conservation facilities improved subcomponents (about $9.3 million) increase the ecosystems' resilience to extreme climate events and will also capture carbon and contribute to climate mitigation. Hence, they are accounted as 50% for climate adaptation and 50% for climate mitigation.

Improving hydrological and water quality monitoring capacity and training and capacity building to enhance people's awareness of climate change impacts and provide the concept of best international practices for sponge city development under the FERM capacity enhanced subcomponent are estimated at about $4.1 million.