# CLIMATE CHANGE ASSESSMENT

## I. BASIC PROJECT INFORMATION

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|---|---|
| **Project Title:** | Jiangxi Ganzhou Rural Vitalization and Comprehensive Environment Improvement |
| **Project Cost** ($ million)**:** | 455.67 |
| **Location:** | Ganzhou Municipality, Jiangxi Province, People's Republic of China (PRC) |
| **Sector:** | Agriculture, Nature Resources and Rural Development |
| **Theme:** | Natural resource management, ecological and environmental protection, sustainable rural development |
| **Brief Description:** | The project will result in the following outcome: living environment of rural areas along upper reaches of the Gan River improved. The project will strengthen the environmental monitoring and enforcement, and the urban-rural integration in the Ganzhou Municipality. The project has the following outputs:<br>Output 1: Institutional capacity and knowledge for environmental management enhanced;<br>Output 2: Green development and financing mechanisms piloted;<br>Output 3: Rural waste and sanitation management improved; and<br>Output 4: Water and soil conservation practices improved. |

Source: Asian Development Bank.

## II. SUMMARY OF CLIMATE CHANGE FINANCE

| **Project Financing** | | **Climate Finance** | |
|---|---|---|---|
| **Source** | **Amount** ($ million) | **Adaptation** ($ million) | **Mitigation** ($ million) |
| **Asian Development Bank** | | | |
| Ordinary capital resources (regular loan) | 200.00 | 44.77 | 35.17 |
| **Counterpart** | | | |
| Governments | 255.67 | 19.15 | 18.77 |
| **Total** | **455.67** | **63.92** | **53.94** |

Source: Asian Development Bank.

## III. SUMMARY OF CLIMATE RISK SCREENING AND ASSESSMENT

### A. Sensitivity of Project Components to Climate or Weather Conditions and the Sea Level

1. **Rural environment infrastructure.** Higher temperature may affect the operation of wastewater facilities; more precipitation and intense storms may increase the risk of flood damage to rural infrastructures.

2. **River rehabilitation.** More precipitation and intense storms may increase the risk of river flooding; temperature and precipitation pattern variation may change watershed runoff in quantity and quality leading to ecological degradation.

3. **Agriculture.** Large temperature difference may cause crop degradation; more precipitation and intense storms may cause increased flood damage to the agricultural facilities.

4. **Forestry.** High evaporation and low precipitation for long time may cause drought, plant death and increased risk for wildfire.

5. **Water and soil conservation.** Peak intense precipitation may intensify soil erosion and landslides.

### B. Climate Risk Screening

According to the statistical analyses of historical climate data in Ganzhou from 1960 to 2019, the annual mean temperature showed an overall increasing trend and raised from 19.14°C in 1960 to 19.96°C in 2019. The average temperatures in both summer and winter increased during 1960–2019, and summer temperature increased at a fast rate after 2000. The number of high temperature days (>35°C) in summer steadily increased in general during 1960–2019 in Ganzhou and nearly doubled in 2019 compared with the number in 1960. The number of low temperature days (<0°C) in winter steadily decreased in general during 1960–2019 in Ganzhou and nearly halved in 2019 compared with the number in 1960. It can be concluded that Ganzhou is experiencing more extreme heats in summer and a warmer winter with less extremely cold days. The annual precipitation fluctuated largely from 1960 to 2019 with a slightly increasing trend in general, while the number of rainy days in winter season steadily decreased.

The climate risk screening identified the following risks which may affect the project: (i) the temperature increase, especially the increased extreme high temperature events in the summer, may cause higher evaporation and more frequent droughts; and (ii) the increase in rainfall variability and the intensity of extreme rainfall events may potentially increase the flood and drought risk.

Climate Risk Classification: *medium*

**C. Climate Risk and Adaptation Assessment**

The temperature and precipitation variations during 2021–2100 in the region of Ganzhou Municipality were projected for future climate change analysis under three Representative Concentration Pathway (RCP) scenarios (RCP 4.5, RCP 6.0, and RCP 8.5). The projected climate change trend is based on the analysis for decadal climate conditions from 2021 to 2100 with reference to baseline period of 1989 to 2019.

**Temperature.** Under each RCP scenario, the annual mean, minimum and maximum temperatures will increase during 2020 to 2100 in general, while the magnitude of warming trend is very scenario-based. The annual average temperature is projected to increase 1.10°C–1.93°C in 2050 and 1.88°C–3.60°C in 2080 under RCP4.5, RCP6.0 and RCP8.5 scenarios, which reveals a substantial warming trend in Ganzhou. The annual maximum temperature is projected to increase 1.09°C–2.03°C in 2050 and 1.98°C–3.74°C in 2080 under different scenarios. The annual minimum temperature is projected to increase 1.07°C–1.87°C in 2050 and 1.79°C–3.50°C in 2080.

**Precipitation.** The projected precipitation in Ganzhou in 2021 to 2100 fluctuates between –8.64% and 12.94% with a slightly increasing trend in general. The annual precipitation is projected to increase 3.06% to 6.17% under three RCP scenarios in 2080. The projection of monthly precipitation distribution reveals a wide variation range which leads to a higher risk of flood and drought.

**1. Agriculture development**

**Potential climate risks:** Lower precipitation and prolong drought in the farming season may cause crop degradation and production reduction; increasing frequency and extent of intense rainfall may affect soil moisture and cause food damage to the growth of crops.

**Risk level:** high for drought, medium for flooding

**Adaptation options:** (i) Promotion of water saving irrigation techniques, such as drip irrigation; (ii) construction and renovation of irrigation and drainage ditches in the farmlands; and (iii) adjustment of farming management measures, including schedule adjustment of sowing, irrigation, fertilization and harvesting, reseeding, fostering seedlings.

**2. Eco-tourism facility improvement**

**Potential climate risks:** The high intensity rainfall may cause more water logging and flooding damage to rural infrastructures and ecological conditions on impermeable surface.

**Risk level:** medium

**Adaptation options**: Adoption of the low-impact development strategy in the infrastructure construction, including pervious surface to allow water flow, sunken green space to absorb more water, tourism infrastructures with natural and green features to uplift the climate resilience.

**3. River rehabilitation**

**Potential climate risks:** Heavy rain events on impermeable revetment will generate concentrated stormwater runoff with first flush pollution, which may cause river quality degradation and river flooding.

**Risk level:** medium

**Adaptation options:** (i) Adopting ecological revetment structures with natural ang green features to maintain the patterns of hydrological exchange; and (ii) building vegetation buffer zone in the riparian area to reduce the peak surface runoff flow.

**4. Wetland protection and soil conservation**.

**Potential climate risks:** Increasing temperature and variable rainfall pattern may strengthen water evaporation and soil erosion and cause ecological degradation.

**Risk level:** low

**Adaptation options**: (i) Planting vegetation and trees on the slope of collapsing hills; and (ii) establishment of wetland and natural park monitoring and management system.

**5. Afforestation and sustainable forest management**

**Potential climate risks**: Prolonged drought and warmer winter may cause increased risk of wildfire and pest breakout.

**Risk level:** high

**Adaptation options**: (i) Improvement of forestry monitoring and warning system; (ii) enhancing pest and disease prevention; (iii) construction of biological fire-barrier tree belt; and (iv) forest tendering and enclosed protection.

**D. Climate Risk Screening Tool and/or Procedure Used**

Preliminary risk screening was conducted in accordance with the Asian Development Bank's climate change risk management framework.

FI = financial intermediary, RCP = Representative Concentration Pathways.
Source: Asian Development Bank.

## IV. CLIMATE ADAPTATION PLANS WITHIN THE PROJECT

| Adaptation Activity | Target Climate Risk | Estimated Adaptation Costs ($ million) | Adaptation Finance Justification |
|---|---|---|---|
| Water saving irrigation facilities | Higher temperature and prolong drought cause crop degradation or production reduction. | 1.43 (ADB loan: 1.43) | Additional investment cost of adopting drip irrigation system in replacement of open channel irrigation in the original design. |
| Pervious pavement construction | High intensity rain might cause more water logging and flooding damage to the rural infrastructures and ecological conditions on impermeable surface. | 1.01 (ADB loan: 1.01) | Additional investment cost of adopting permeable OGFC asphalt concrete pavement in replacement of impermeable asphalt pavement in the original design. |
| Ecological revetment construction | | 6.48 (ADB loan: 6.48) | Additional investment cost of adopting stone gabion revetment with green |

| **Adaptation Activity** | **Target Climate Risk** | **Estimated Adaptation Costs** ($ million) | **Adaptation Finance Justification** |
|---|---|---|---|
| | | | features in replacement of grouted rubble revetment in the original design. |
| Vegetation buffer zone | | 8.38 (ADB loan: 4.11) | Vegetation buffer zone contributes for dual benefits and its 50% cost is counted as adaptation cost. |
| Repairment of irrigation and drainage ditch in the farmlands | Uneven precipitation distribution and increasing intense rainfall may affect soil moisture and cause food/drought damage to crops. | 18.94 (ADB loan: 9.28) | The investment cost of repairment of 131 km irrigation and drainage ditches in the farmlands. |
| Water and soil conservation practices | Uneven precipitation distribution might cause higher frequency of flooding leading to water loss and soil erosion. | 4.68 (ADB loan: 2.29) | The investment cost of check dams, ecological retaining walls, drainage canals, etc. to restore collapsed slopes in Nankang District and Yudu County. |
| Establishment of wetland management system | Change of temperature and rainfall pattern may cause soil erosion and ecological degradation in the wetlands | 0.78 (ADB loan: 0.78) | The investment cost of wetland monitoring system development, ecological investigation and pest inspection in Huichang National Wetland Park. |
| Forest fire prevention and pest disease control | Prolonged drought and warmer winter cause increased risk of wildfire and pest outbreak. | 5.55 (ADB loan: 2.72) | The investment costs of forest fire-protection belt development, forest fire monitoring and emergent response system, and forest disease control measures. |
| Green financing through FI loan component | Higher temperatures, variant precipitation and intense storms, might result in water resource scarcity, frequent flood/drought, ecological degradation, crop production reduction, etc. | 16.67 (ADB loan: 16.67) | According to the ratio of performance indicators, one third of the component's financing is counted as dual benefit climate financing. One-sixth of the cost is estimated as adaptation cost. |
| **Total (Estimated Adaptation Cost)** | | **63.92 (ADB loan: 44.77)** | |

ADB = Asian Development Bank, FI = financial intermediary, km = kilometer, OGFC = open graded friction courses.
Source: Asian Development Bank.

## V. CLIMATE MITIGATION PLANS WITHIN THE PROJECT

| **Mitigation Activity** | **Estimated GHG Emissions Reduction** ($tCO_2e$/year)[a] | **Estimated Mitigation Costs** ($ million) | **Mitigation Finance Justification** |
|---|---|---|---|
| Afforestation, plantation and reforestation | 65,795 | 31.95 (ADB loan: 15.66) | The project will afforest and plant grass for soil conservation and reforest to improve forest quality. The related contents are considered a mitigation component per Subcategory 4.2 of the list of eligible mitigation activities under the Guidance Note on Counting Climate Finance at ADB.[b] |
| Solar-powered facilities (160 solar bug zappers and 4,708 solar streetlamps) | 3,000[c] | 2.37 (ADB loan: 1.16) | The applications of solar-powered facilities can be considered mitigation activities per subcategory 1.2 of the list of eligible mitigation activities under the guidance note. The investment costs of solar streetlamps and solar bug zappers are considered mitigation finance. |
| Green financing through FI loan component | 16,000[d] | 16.67 (ADB loan: 16.67) | The component will expand the loan financing for rural business, environmental protection and climate resilience in Ganzhou. The green financing component is considered a mitigation component per subcategory 9.2 financing instruments of the list of eligible mitigation activities under the guidance note. Only one sixth of the cost is considered mitigation finance. |
| Forestry carbon credit pilot program | 15,750 | 2.64 (ADB loan: 1.37) | A forestry carbon credit program will be piloted for about 3,500 ha forests in the Chongyi County under the framework of CCER. The costs of consulting services in registration, verification and monitoring of carbon sequestration and the related forestry management improvement activities are considered mitigation finance. |
| Agricultural waste management study and pilot | 561 | 0.31 (ADB loan: 0.31) | The program will study and pilot to reuse the agricultural waste as a resource with methane and $N_2O$ reduction. The investment cost of the program is considered mitigation finance. |
| **Total (Estimated Mitigation Cost)** | | **53.94 (ADB loan: 35.17)** | |

ADB = Asian Development Bank, CCER = Chinese Certified Emission Reduction, FI = financial intermediary, ha = hectare, GHG = greenhouse gas, $N_2O$ = nitrous oxide, $tCO_2e$ = tons of carbon dioxide equivalent.

[a] Energy savings/year x emission factor = GHG emissions reduction.

[b] 2016. ADB. *Guidance Note on Counting Climate Finance*. Manila.

[c] Assuming the average electricity consumptions are 730 kilowatt-hour/year (0.25 = kilowatt (kW)*8 hours/day*365 days/year) of 4708 streetlamps and 350 kWh/year (0.04 kw*24 hours/day*365days/year) of 160 bug zappers, and there is an electricity emission factor of 0.8587 $tCO_2e$/ megawatt-hour (MWh) and 100% savings. The resulting number, 2999.36, was rounded to 3000 $tCO_2e$/ year.

[d] Assuming the FI loan component supports at least one 10MV solar energy project that produces 18,600 MWh and the electricity emission factor for Jiangxi Province is 0.8587 $tCO_2e$/MWh. The resulting number 15,972 was rounded down to 16,000 $tCO_2e$/ year.

Source: Asian Development Bank.