# CLIMATE CHANGE ASSESSMENT[1]

## I. BASIC PROJECT INFORMATION

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|---|---|
| **Project Title:** | Yunnan Sayu River Basin Rural Water Pollution Management and Eco-Compensation Demonstration Project |
| **Project Cost** ($ million)**:** | 234.61 |
| **Location:** | Zhaotong City, Yunnan Province, People's Republic of China |
| **Sector:** | Agriculture, natural resources, and rural development |
| **Theme:** | Inclusive economic growth, environmentally sustainable growth |
| **Brief Description:** | The project is aligned with the following impact: quality of life and sustainable aquatic ecosystem in the Yangtze River Basin improved. The project will have the following outcome: condition of water resources and environment in the Sayu River Basin improved. The project will have the following outputs:<br><br>Output 1: Wastewater management and pollution control in the Sayu River Basin strengthened.<br>Output 2: Water resources management in the Sayu River improved.<br>Output 3: Eco-compensation mechanism for the Sayu River Basin established.<br>Output 4: Education, capacity, and public awareness for water pollution management strengthened. |

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) | 22.61 | 9.72 | 12.89 |

Note: Numbers may not sum precisely because of rounding.
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. **Wastewater management system.** Increasing frequency and extent of heatwaves, floods, and droughts may cause pipe cracking.
2. **Animal feces management.** Increasing frequency of intense rain may cause contamination accidents.
3. **Reduction of nonpoint source pollution by artificial wetlands.** Increasing frequency and extent of intense rain may increase flow to wetlands. Increasing extent of droughts may affect wetlands by hindering the growth of plants and/or damaging plants.
4. **Reduction of soil erosion by afforestation.** Extreme changes in temperature leading to heatwaves, prolonged droughts, etc. may affect afforestation by hindering the growth of plants and/or damaging plants.
5. **Promotion of low-emission agriculture.** Increasing frequency and extent of intense rain may increase flow to demonstration bases. Increasing extent of droughts may affect promotion of low-emission agriculture in the demonstration bases by hindering the growth of crops and/or damaging crops (frost damage or wilting).

[1] This report was prepared based on a detailed climate risk and vulnerability assessment conducted by a climate change specialist for the transaction technical assistance for project preparation.

6. **Protection of rivers from pollution by ecological embankments.** Increasing frequency and extent of intense rain may cause floods and deteriorate the river water quality.

**B. Climate Risk Screening**

The future climate change was projected based on the Regional Climate Model RegCM4 under the two representative concentration pathway (RCP) scenarios, RCP4.5 and RCP8.5. The projected climate change trend is based on the analysis for 2015–2099; while the decadal mean, monthly mean temperature and precipitation changes, and the changes in frequency of maximum daily rainfall are based on the analysis for 2021–2050. The baseline period for the study is 1986–2005.

1. **Temperature increases.** The projected changes of annual mean temperature show substantial warming during 2015–2099, with more than 0.37°C/10 years under RCP8.5; and about 0.13°C/10 years under RCP4.5. In the project area, monthly temperatures are projected to increase consistently during 2021–2050 under RCP4.5 and RCP8.5. Mean temperatures will range from 0.5°C to 1.5°C under RCP4.5, and 0.7°C to 1.8°C under RCP8.5. The temperature rise in March will substantially be higher than any other months in a year.

2. **Rainfall changes.** There is no clear trend of projected annual precipitation during 2015–2099 under RCP4.5, while annual precipitation is projected to decrease by 13.5 millimeters (mm)/10 years under RCP8.5. Monthly precipitation is projected to decrease consistently during February–June under RCP4.5 and RCP8.5, with March having the biggest decrease amounting to about 19% and 27% under RCP4.5 and RCP8.5, respectively. However, precipitation is projected to increase in January, September, and October. Especially in September, the increase is projected to be more than 22% and 26% under RCP4.5 and RCP8.5, respectively. There is projected increase by 4%–11% in maximum daily rainfall with 50-year and 100-year return period in 2030s under RCP 4.5 and in maximum rainfall with 100-year return period in 2020s under RCP8.5. Maximum daily rainfall with the other return periods or in the other years is projected to decrease.

The climate risk screening identified the following risks which may affect the project: increase of frequency and extent of intense rain and floods; extreme changes in temperature leading to heatwaves, etc.; and increasing extent of droughts.

Climate Risk Classification: *medium*

**C. Climate Risk and Adaptation Assessment**

**1. Wastewater Management System**

**Potential climate risk:** Increasing frequency and extent of heatwaves, floods, and droughts may cause pipe cracking.

**Risk level:** High

**Adaptation options:** Wastewater collection pipes which are more resistant against heatwaves, floods, and droughts should be used.

**2. Animal Feces Management**

**Potential climate risk:** Increasing frequency of intense rain may cause contamination accidents.

**Risk level:** High

**Adaptation options:** The capacity of a manure collection tank should be increased to avoid contamination accidents to be caused by increasing frequency and extent of intense rain.

**3. Reduction of Nonpoint Source Pollution by Artificial Wetlands**

**Potential climate risk:** Increasing frequency and extent of intense rain may increase flow to wetlands. Increasing extent of droughts may affect wetlands by hindering the growth of plants and/or damaging plants.

**Risk level:** Medium

**Adaptation options:** (i) The capacity of wetland for wastewater treatment should be increased, considering the increasing frequency and extent of intense rain; and (ii) drainage ditches and pumping systems should be constructed to provide adequate water to the wetlands even during droughts, considering the increasing

extent of droughts.

**4. Reduction of Soil Erosion by Afforestation**

**Potential climate risk:** Extreme changes in temperature leading to heatwaves, prolonged droughts, etc. may affect afforestation by hindering the growth of plants and/or damaging plants.

**Risk level:** Medium

**Adaptation options:** (i) climate-resistant tree species which can endure heatwaves, prolonged droughts, etc. should be used; (ii) irrigation facilities should be constructed to provide necessary water to afforestation areas, considering the increasing extent of droughts; and (iii) monitoring of planted trees should be conducted to prevent pests.

**5. Promotion of Low-Emission Agriculture**

**Potential climate risk:** Increasing frequency and extent of intense rain may increase flow to demonstration bases. Increasing extent of droughts may affect promotion of low-emission agriculture in the demonstration bases by hindering the growth of crops and/or damaging crops (frost damage or wilting).

**Risk level:** Medium

**Adaptation options:** (i) Efficient water-saving irrigation facilities should be constructed, considering the increasing extent of droughts; and (ii) capacities of ecological drainage ditches should be increased, considering the increasing frequency and extent of intense rain.

**6. Protection of Rivers from Pollution by Ecological Embankments**

**Potential climate risk:** Increasing frequency and extent of intense rain may cause floods and deteriorate the river water quality.

**Risk level:** Medium

**Adaptation options:** (i) Flood control capacities of rivers should be increased by increasing the freeboard of ecological embankments, considering the increasing frequency and extent of foods; (ii) flood warning should be strengthened; and (iii) river water quality monitoring should be strengthened.

**7. Capacity Development and Education**

**Potential climate risk:** Government staff's capacities to address climate change and public awareness of climate change are low.

**Risk level:** Medium

**Adaptation options:** (i) Government staff's capacities to address climate change should be developed, and (ii) education of students should be conducted to increase awareness of climate change.

**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.

Source: Asian Development Bank.

## IV. CLIMATE ADAPTATION PLANS WITHIN THE PROJECT

| Adaptation Activity | Target Climate Risk | Estimated Adaptation Costs ($ million) | Adaptation Finance Justification |
|---|---|---|---|
| Use more resistant pipes for wastewater collection. | Increasing frequency and extent of heatwaves, floods, and droughts may cause pipe cracking. | 1.00 (ADB loan: 0.80) | 328 km wastewater collection pipes will be installed. More resistant pipes cost $3,050/km more than regular pipes. |

| Adaptation Activity | Target Climate Risk | Estimated Adaptation Costs ($ million) | Adaptation Finance Justification |
|---|---|---|---|
| Increased the height of each manure collection tank by 20 cm. | Increasing frequency of intense rain may cause contamination accidents. | 2.41 (ADB loan: 1.93) | 17,323 manure collection tanks will be installed. Addition of the height to each tank costs $139. |
| Expanded wetland area, added a drainage ditch, and added pumping systems. | Increasing frequency and extent of intense rain may increase flow to wetlands. Increasing extent of droughts may affect wetlands by hindering the growth of plants and/or damaging plants. | 0.58 (ADB loan: 0.45) | The increase of the wetland area by 3.56 ha costs $203,000. The additional 30-meter drainage ditch costs $6,000. The additional pumping systems costs $370,000. |
| Use more resistant tree species and added pest monitoring and irrigation facilities for afforestation. | Extreme changes in temperature leading to heatwaves, prolonged droughts, etc. may affect afforestation by hindering the growth of plants and/or damaging plants. | 3.86 (ADB loan: 2.95) | More resistant plant species cost $6,630/ha more than regular species, for a total of 308.51 ha afforestation area. The additional irrigation facilities cost $1.75 million. Pest monitoring costs $60,000. |
| Added efficient water-saving irrigation facilities and increased the height of ecological drainage ditches. | Increasing frequency and extent of intense rain may increase flow to demonstration bases. Increasing extent of droughts may affect promotion of low-emission agriculture in the demonstration bases by hindering the growth of crops and/or damaging crops (frost damage or wilting). | 3.46 (ADB loan: 2.76) | The added efficient water-saving irrigation facilities for 437.5 ha cost $6,600/ha. The increased heights of the 3.17 km ecological drainage ditches by 21–36 cm cost $0.57 million. |
| Increased the freeboard of ecological embankments | Increasing frequency and extent of intense rain may cause floods and deteriorate river water quality. | 0.55 (ADB loan: 0.20) | 98.3 km ecological embankments will be constructed. The increase of freeboard of the embankments by 20 cm costs $5,600/km. |
| Strengthen monitoring | Increasing frequency and extent of intense rain may cause floods and deteriorate river water quality. | 0.63 (ADB loan: 0.63) | Out of $1,248,824 for a contract package to purchase equipment for information management and water monitoring systems, $630,000 will be used for flood warning and water quality monitoring. |
| Develop capacities of government staff and educate students for climate change. | Government staff's capacities to address climate change and public awareness of climate change are low. | 0.09 (ADB loan: 0.00) | Out of $308,592 for capacity development of government staff and education of students, $90,000 will be used for capacity development and education related to climate change. |

| Adaptation Activity | Target Climate Risk | Estimated Adaptation Costs ($ million) | Adaptation Finance Justification |
|---|---|---|---|
| **Total (Estimated Adaptation Cost)** | | **12.57 (ADB loan: 9.72)** | |

ADB = Asian Development Bank, cm = centimeter, ha = hectare, km = kilometer.
Note: Numbers may not sum precisely because of rounding.
Source: ADB.

## V. CLIMATE MITIGATION PLANS WITHIN THE PROJECT

| Mitigation Activity | Estimated GHG Emissions Reduction ($tCO_2e$/year)[a] | Estimated Mitigation Costs ($ million) | Mitigation Finance Justification |
|---|---|---|---|
| Install solar panels to 42 wastewater treatment facilities | 103[b] | 0.37 (ADB loan: 0.20) | Cost of the solar panels |
| Construct two garbage pyrolysis facilities | 782[c] | 4.15 (ADB loan: 3.83) | Cost of the two garbage pyrolysis facilities |
| Construct wetlands | 19[d] | 8.21 (ADB loan: 6.36) | Cost of new wetland construction minus $0.58 million for adaptation (for the increased wetland area, added drainage ditch, and added pumping systems) |
| Conduct afforestation | 1,489[e] | 3.27 (ADB loan: 2.50) | Cost of afforestation minus $3.86 million for adaptation (for more resistant plant species, additional irrigation facilities, and pest monitoring) |
| **Total (Estimated Mitigation Cost)** | | **15.99 (ADB loan: 12.89)** | |

ADB = Asian Development Bank, GHG = greenhouse gas, ha = hectare, MWh = megawatt hour, $tCO_2e$ = tons of carbon dioxide equivalent.
Note: Numbers may not sum precisely because of rounding.
[a] Energy savings/year x emission factor = GHG emission reduction.
[b] Calculated based on the Baseline Emission Factors for Mitigation Project of China Regional Power Grid in 2017 published by the Ministry of Ecology and Environment. About 1 MWh of solar electricity equals the GHG reduction of 0.79 $tCO_2e$. Annual electricity generated by the solar panels at each treatment facility is about 3.1 MWh.
[c] Calculated based on the Guidelines for the Preparation of Provincial Greenhouse Gas Inventories (2011). Treatment of 84 tons/day of solid waste by the two garbage pyrolysis facilities will result in the GHG reduction about 782 $tCO_2e$/year.
[d] About 38.03 ha of new wetlands will be constructed. Annual carbon sequestration capacity of wetlands is 0.500 $tCO_2e$/ha/year.
[e] Afforestation will be conducted in the 448.42-ha area. Annual carbon sequestration capacity of forests is 3.32 $tCO_2e$/ha/year.
Source: Asian Development Bank.