CLIMATE CHANGE ASSESSMENT

I. BASIC PROJECT INFORMATION

Project Title:	CAREC Corridor 2 Karakalpakstan Road (A380 Kungrad to Daut-Ata Section) Project
Project Cost ($ million)**:**	$384.4 million
Location:	Karakalpakstan, Uzbekistan
Sector:	Transport
Theme:	Road Transport
Brief Description:	The project aims to upgrade and widen the existing Kungrad to Daut-Ata highway in Kungrad province of the Republic of Karakalpakstan. The plan is to reconstruct a 240 km section of A-380 highway "Guzar-Bukhara-Nukus-Beineu" between Kungrad and Daut-Ata from km 964 to km 1204. The road will be a two-lane cemented road featuring 3.75-meter (m) traffic lanes with adjacent shoulders featuring a configuration of 0.75 m paved and 3.00 m unpaved.

M = meter
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)	248.2	0.4	
Ordinary capital resources (concessional loan)	26.0	17.0	
Co-financing			
Government of Uzbekistan	109.2		
Total	383.4	17.4	

Sources: 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

Karakalpakstan is in an area characterized by a very arid climate and it is reported to be the most climate vulnerable province in Uzbekistan.[1] Increased average temperature and extreme temperatures events may affect proposed road pavements and bridges. Increased salinity levels may reduce the structural strength of pavements and lead to rusting of the reinforcement in concrete structures. Increasing temperatures may also cause dust storms thus undermining the road quality during its economic life.[2]

Historical records from the UN Global Risk Platform[3] revealed the project area, being part of Ustyurt plateau desert, has historically limited geological and climate hazards. The platform keeps track of floods, drought, and earthquake events among others and the entire alignment has no record. The pro hazards to include of human, and economic hazards. The same Platform estimated flood risk is between US$7-50M/year, however, the population exposed is very small. The flood hazard map is provided in Appendix that shows 5 locations where the flooding could occur and adequate cross drainage, embankment height, and strengthening may be required.

B. Climate Risk Screening

1. Project is in an area with low risk of landslide and flooding.[4]

[1] Republic of Uzbekistan. 2016. Third National Communications of the Republic of Uzbekistan under the UNFCCC. Tashkent.
[2] ADB. 2011. Guidelines for Climate Proofing Investment in the Transport Sector Road Infrastructure Projects. Manila
[3] Global Risk Platform, United Nations Environment Program (UNEP) and United Nation Office for Disaster Risk Reduction (UNISDR). https://preview.grid.unep.ch/index.php?preview=map&lang=eng
[4] Desk-based analysis using World Bank Group Climate Change Portal and UNEP PREVIEW Data Platform.

2. Average annual temperature and the magnitude and frequency of extreme temperature events is expected to increase, which may affect performance of road materials.[5]

Climate Risk Classification: Medium

C. Climate Risk and Adaptation Assessment

The project climate risk assessment (CRA) was based on an earlier assessment undertaken for an ADB project in the Karakalpakstan region.[6] The approach uses an ensemble of models covering a wide range of projections for one or more climatological variables of interest. Four representative marker scenarios are then selected from the pool corresponding GCM runs from the CMIP5 RCP4.5 and RCP8.5 ensembles to capture the envelope of feasible outcomes (see Appendix). Key results of the key marker scenarios are as follows:

1. **Temperature increase.** For Uzbekistan, climate change is expected to produce increases in monthly maximum temperatures. Model ensemble's estimate of warming under the highest emission pathway (RCP 8.5) with an average temperature increase of 2.4ºC by mid-century and nearly 5ºC by end of the century. The number of hot days is also projected to increase by 28.6 days by 2040-2059 days, under RCP 8.5 scenario.
2. **Rainfall increase.** Mean annual precipitation will rise by 11.7mm in 2050 (RCP 8.5, High Emission). However, there will be high variability of rainfall with spatial differences 50-100mm in some central and eastern districts and moderately increasing in areas surrounding the Aral Sea.

D. Climate Risk Screening Tool and/or Procedure Used

ADB Preliminary Climate Risk Screening (part of Environmental Categorization)
UNEP PREVIEW Data Platform
World Bank Group Climate Change Portal

ADB = Asian Development Bank; CRA = climate risk assessment; GCM = General Circulation Model; CMIP5= Coupled Model Intercomparison Project Phase 5 Representative Concentration Pathway; UNEP = United Nation Environment Program

IV. CLIMATE ADAPTATION PLANS WITHIN THE PROJECT

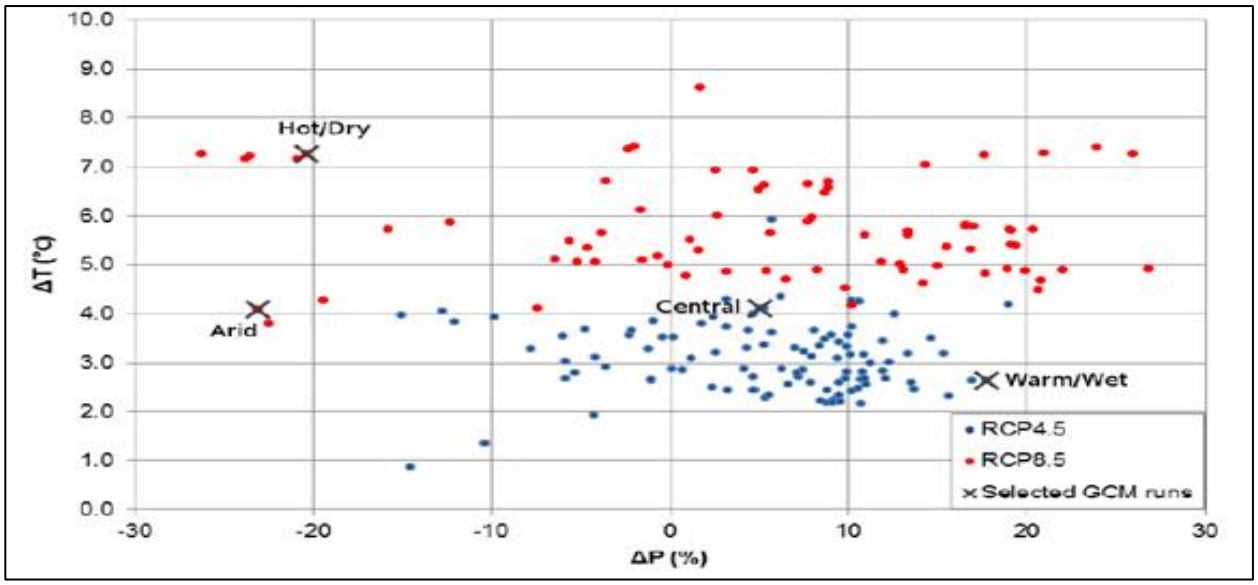
Adaptation Activity	Target Climate Risk	Estimated Adaptation Costs	Adaptation Finance Justification
Better road drainage systems: reconstructed drainage with larger than standard capacity.	Flash floods Prolonged period of drought causing soil salinization, wind-blown salt in drought / desert/arid areas (i.e., Aral Sea)	$1.0 million	Higher capacity and improved drainage systems will prevent clogging of drains from storm debris, flooding due to higher water volume, and formation of salt residues on the pavement. Estimated cost is based on experience in earlier projects.
Additional costs for avoidance or minimization of salt laden water, construction materials, in dust suppression and destabilization process[7]		$0.1 million	Management of salt content on road construction and maintenance will reduce damage and maintenance cost over the next 30 years. Salt damages the cement, bituminous pavements, and unsealed pavements. Installation of water storage facilities (preferably low salt content or saline free) during the construction period. The water supply system is estimated to need to be able to deliver over 50% more water than in a situation without climate change. Per the climate change assessment, it is estimated that each 1°C increase in mean air temperature

[5] Punkari et al. 2014. Climate change and sustainable water management in Central Asia. Working Paper. Manila. ADB.
[6] Droogers, P. et al. 2017. Climate Risk and Vulnerability Assessment for Western Uzbekistan Water Supply. Consultant's Report. Manila.
[7] R. de Carteret, O. Buzzi and S. Fityus. 2010 A Review of the Effects of Salinity on Road Pavements and Bituminous Surfacing. Melbourne, Australia. 12–15 October 2010.

			with respect to the current situation, leads to an additional water consumption of 20%. Water supply system should be designed to guarantee water supply under the most unfavorable climate change scenario; in this case the hot/dry scenario.
Installation and operation of WIMS and strict enforcement of anti-overloading	Large changes in temperature, strong wind loads	$ 0.2 million	Since the project area is already exposed to high temperatures reaching as high as 40°C, the projected increase temperature due to climate change may cause buckling, cracking, and expansion joint spalling. These damages may allow moisture to penetrate which can cause additional damage due to the freeze-thaw cycle. The use of the WIMS will ensure truck axle loads remain within the design and help ensure accelerated deterioration of the pavement is avoided.
Early warning and response systems for transport ministries to improve maintenance schedules and to respond quickly to post-disaster recovery needs.	Extreme events (floods, sandstorms) that affect the safety and serviceability of the road	$0.1 million	This is a non-structural adaptation measure. It helps reduce the impacts on road safety and usability before, during and after an extreme event.
Temperature-resilient cement concrete pavement	Large changes in temperature	$15 million	The projected increase in temperature was one of the factors for the pavement upgrading from asphalt to concrete. The Committee for Roads has adopted SHNK 2.05.02-07 Highways standards that I suitable for extremely continental. Average temperatures are as follows: in July + 27.0 °C, in January - 8.2 ° C, annual + 9.1 ° C. The absolute minimum temperature was recorded with - 45 ° C, the absolute maximum temperature was + 45.5 ° C. Cement concrete surfaces reflect more heat from sun radiation and have lower surface temperatures in summer than asphalt concrete pavements.
Larger expansion joints	Large changes in temperature	$1 million	The road design considers 3 cm wide expansion joints with soft wood boards at 80 m interval. This type of joints allows for a higher expansion than the common compression joints, cut only in the upper part of the concrete cement slabs.
Total Estimated Cost		$17.4 million	

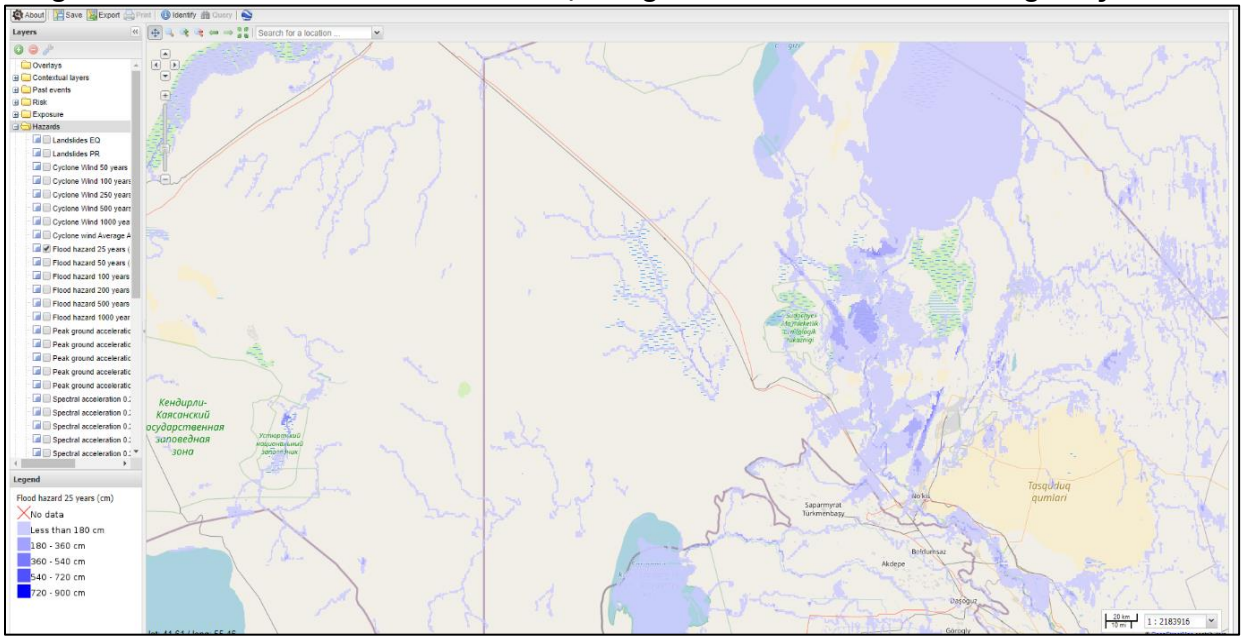
Figure 1: Projected changes in temperature and precipitation for the upstream AMU Darya and Syr Darya basins in Central Asia between 1971-2000 and 2071-2100. All AR5 GCM runs for RCP4.5 and RCP8.5 are shown. Values are average. GCM runs that were selected based on proposed marked scenarios are indicated with black crosses.

Figure 1: IPCC AR5 GCM projected climatic changes
Central Asia between 1971-2000 and 2071-2100S



Source: Droogers, P. et al. 2017. *Climate Risk and Vulnerability Assessment for Western Uzbekistan Water Supply*. Consultant's Report. Manila.

Figure 2: UN Global Risk Data Platform, Kungrad to Daut-Ata Section Highway Section



Source: Droogers, P. et al. 2017. *Climate Risk and Vulnerability Assessment for Western Uzbekistan Water Supply*. Consultant's Report. Manila.