

CLIMATE CHANGE RESILIENCE MEASURES

1. Subprojects in the five project provinces consist of infrastructure improvements such as road upgrades and construction of wastewater treatment plants, drainage and sanitation at established tourist sites (Table 1). A detailed description of the proposed subprojects is in the Project Administration Manual. The sustainability of the completed subprojects depends in part on the resilience of the infrastructure to climate change. Of particular interest are the General Circulation Model (GCM) projected changes to regional average rainfall and wind, and the frequency and severity of storm events which will increase the incidence of inland high water levels in rivers, flooding and land erosion, and landslides.

Table 1: Summary of Planned Infrastructure Subprojects

Subproject, Province	Description
1. Da Dung Cave Access Improvement, Kien Giang	The subproject will improve the 2 km access road, footpaths in the cave, and construct a public tourist reception area with kiosks and sanitation.
2. Lao Cai Cultural Exchange and Tourist Information Center, Lao Cai	The subproject will construct a multipurpose tourist information center with vendor kiosks and public amenities in Lao Cai City.
3. Ta Phin–Ban Khoang Access Road Improvement, Lao Cai	The subproject will improve the 15 km access road and construct parking areas with public sanitation.
4. Muong Phang Access Road Improvement, Dien Bien	The subproject will improve the 19 km access road to the Muong Phang National Historical Site and construct roadside viewing platforms, vendor kiosks, and public sanitation.
5. Dien Bien Phu Cultural Exchange and Tourist Information Center, Dien Bien	The subproject will construct a multipurpose tourist information center with vendor kiosks and public amenities at Dien Bien Garrison.
6. Phu Tu Tourism Zone Environmental Improvements, Kien Giang	The subproject will (i) construct a WWTP with 1,000 m ³ per day capacity; (ii) improve public sanitation and drainage; (iii) upgrade the 4.2 km access road, ferry pier, and green space; and (iv) construct a public market.
7. Ba Den Mountain Environmental Improvements, Tay Ninh	The subproject will (i) construct a WWTP with 1,500 m ³ per day capacity; (ii) extend public concourses around the main pagoda, and improve drainage, footpaths, and water supply; (iii) construct a tourist information center, vendor kiosks and public sanitation; and (iv) construct a service track and refuse transfer bunker.
8. Huong Tich Pagoda Environmental Improvements, Ha Tinh	The subproject will (i) construct WWTP with 1,000 m ³ per day capacity; (ii) improve drainage and water supply; (iii) upgrade the 5 km access road; and (iv) construct a visitor information center, vendor kiosks and public sanitation.
9. Nguyen Du Tourism Zone Environmental Improvements, Ha Tinh	The subproject will (i) upgrade drainage and waste management; and (ii) construct a public service area with parking, public toilets, and interpretative facilities to present the work of revered poet Nguyen Du.

2. The Ministry of Natural Resources and Environment has adopted the climate change scenarios for Viet Nam generated by the GCM of the Meteorological Research Institute (MRI) of Japan¹. The medium greenhouse gas emission scenario computed for 2012 shows mean annual air temperature in the five project provinces increasing from 0.4 – 0.5 degrees Celsius by 2021. An overall increase in rainfall is expected by 2021 in the same scenario, with significant increases in rainfall and the frequency of severe rainfall and flooding events during the rainy season, but with a general decrease in rainfall during the dry season.² Sea level rise in the medium scenario for the coastal zone of Ca Mau - Kien Giang is 9-10 cm by 2021. Given these forecasts, the climate resilience measures included in the preliminary design of the subprojects are summarized below.

¹ MONRE. 2012. *Sea level Rise Scenarios for Viet Nam, abbreviated English Version*. Hanoi.

² UNDP Fact Sheet on Climate Change.

A. Da Dung Cave Access Improvement

3. The foundation of the road will be raised high enough so it will not be affected by increased local flooding caused by projected increases in regional rainfall. The preliminary design has raised the road surface 1 meter above that of the existing road.

B. Lao Cai Cultural Exchange and Tourist Information Center

4. The building and associated facilities will be made of reinforced concrete and other durable materials which will be resistant to potential adverse changes in climatic conditions.

C. Ta Phin-Ban Khoang Access Road Improvement

5. Areas susceptible to subsidence will be strengthened with appropriate engineering techniques and structures to prevent road closures. The design of upgraded bridges and culverts will ensure that the structures are able to withstand storm water runoff and heightened flow events. The foundations of the public toilets in Ta Phin village will be set above the floodline.

D. Muong Phang Access Road Improvement

6. Areas susceptible to subsidence will be strengthened with appropriate engineering techniques and structures to prevent road closures. The design of upgraded bridges and culverts will ensure that the structures are able to withstand storm water runoff and heightened flow events. The foundations of walking paths and public toilets at the Muong Phang tourist site will be set above the floodline.

E. Dien Bien Phu Cultural Exchange and Tourist Information Center

7. The building and associated facilities will be made of reinforced concrete and durable materials which will be resistant to potential adverse changes in climatic conditions.

F. Phu Tu Environmental Improvement

8. Sea level rise and elevated storm surges are the major climate change-related issues that must be factored into the designs of all subproject components, particularly rehabilitation of the pier and shoreline walkways. The foundation and shoulders of the upgraded access road to the new pier will be raised to a level that will avoid exposure to future heightened storm surges. The walkways and rehabilitated pier will be constructed of reinforced concrete resistant to marine corrosion and able to withstand storm surges. The placement of anaerobic baffled reactor septic tank(s) and infiltration gallery will prevent exposure to rainfall runoff or seawater infiltration.

G. Ba Den Mountain Environmental Improvement

9. The extended public concourse at the top of mountain will be built of reinforced concrete which is resilient to climate change. The foundation of the wastewater treatment plant will be raised high enough so as not be affected by flooding events. Specially designed surface runoff drainage channels will be installed to direct heavy rainfall around and away from the site. All water pumping equipment will be corrosion resistant.

H. Huong Tich Environmental Improvements

10. For the road upgrade, areas susceptible to subsidence will be strengthened with appropriate engineering techniques and structures. The foundation and drainage of the road will be graded to a level to resist erosion. The design of upgraded bridges and culverts will ensure that the structures are able to withstand storm water runoff and heightened flow events. The site for the wastewater treatment plant is about 300 meters above sea level. Specially designed surface runoff drainage channels will be installed to direct heavy rainfall around and away from the site. All water pumping equipment will be corrosion resistant.

I. Nguyen Du National Special Tourism Zone Environmental Improvements

11. Drainage canals and the water retention area will be lined with reinforced concrete and able to withstand heavy rainfall events. The foundation of the parking area, toilets, and other tourist facilities will be raised high enough so as not be affected by flooding events.

J. Reduced Greenhouse Gas Emissions

12. The subprojects incorporate climate-friendly infrastructure technology that will reduce greenhouse gas emissions and the carbon footprint of the tourist facilities. Strategies to reduce greenhouse gas emissions are, for example, installation of energy efficient lighting at all tourist sites; enforcing directives for tourism transport providers to comply with speed limits and properly maintain their vehicles; promotion of low-carbon transportation in tourist sites (electric vehicles and human-powered vehicles/walking); and the application of energy efficient technologies for solid waste and wastewater management at the tourist sites. In particular are the wastewater treatment plants Ba Den Mountain and Huong Tich Pagoda, and the use of ABR septic and infiltration field technology to treat wastewater at other project sites. The replacement of pit latrines and poorly maintained septic tanks with the in-field ABR systems will reduce emissions of greenhouse gases (i.e., methane) to the atmosphere. The project will also support the national and provincial tourism authorities to implement the green hotel standard/certification program agreed by the Association of Southeast Asian Nations (ASEAN).³

³ ASEAN Secretariat. 2008. *ASEAN Tourism Standards*. Jakarta. There are 6 standards: (i) green hotel, (ii) food and beverage services; (iii) public restroom, (iv) home stay, (v) ecotourism, and (vi) tourism heritage.