Climate Change Adaptation for Solomon Islands Road Improvement (Sector) Project

- Results of Preliminary Assessment

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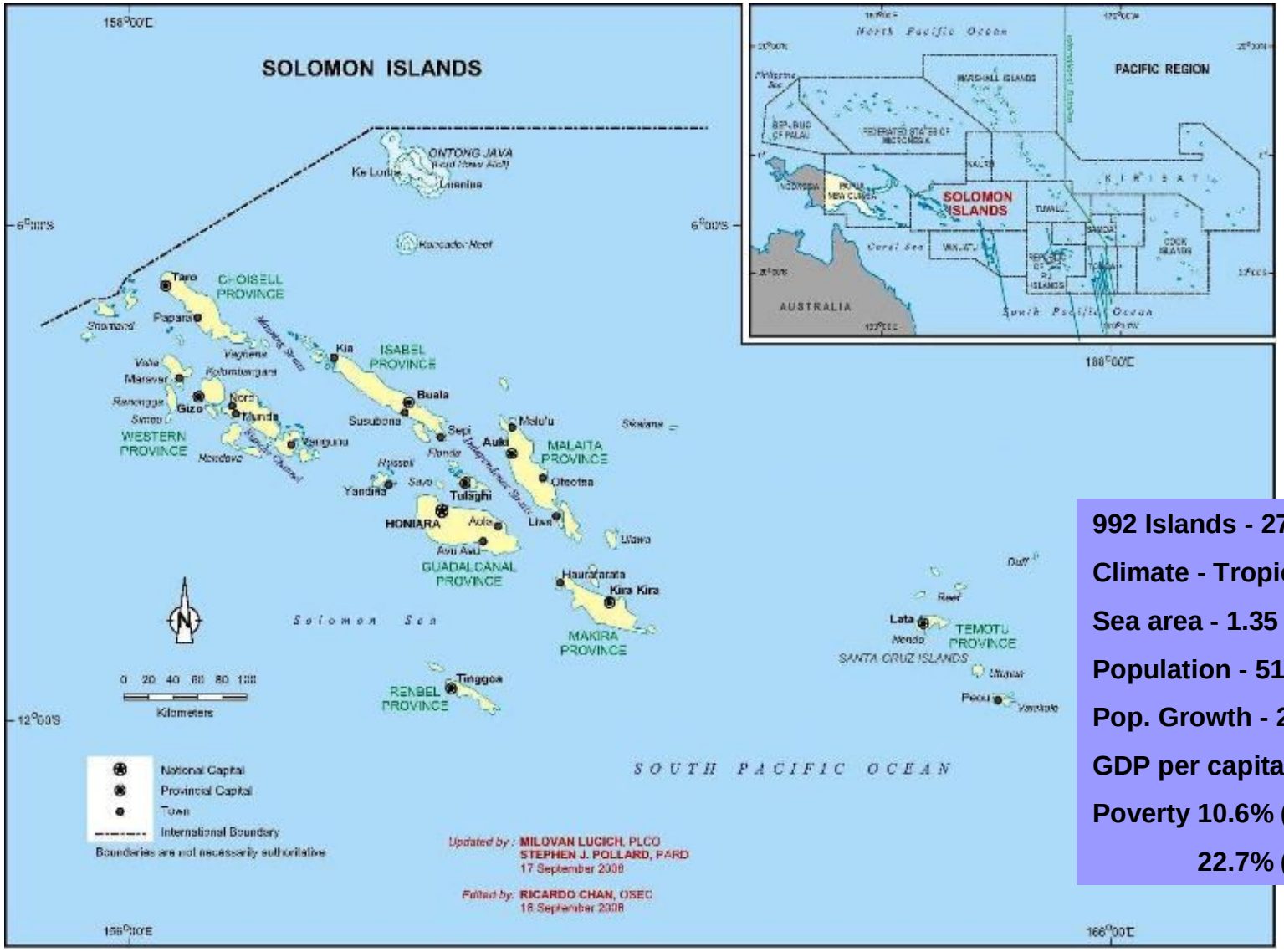
Overview

- Background
  - Road infrastructure
  - Damage and loss on infrastructure
  - Projects
- Climate Change Adaptation
  - Strategy
  - Process
  - Approach
  - Risk assessment – root causes, climate change pattern
  - Engineer response
  - Non-engineer response

Solomon Islands



992 Islands - 27,540 km^2

Climate - Tropical Monsoon

Sea area - 1.35 million km^2

Population - 510,000

Pop. Growth - 2.8%

GDP per capita - $1,235

Poverty 10.6% (foods)

22.7% (basic needs)

Background Information
- Road Infrastructure

- Road network: 1,950 km
  - 60% on Guadalcanal and Malaita provinces, serving 90% of total traffic
  - 1,570 km – gravel
  - 130 km – sealed
- Problems:
  - Frequent natural disasters
    - earthquake
    - tsunami
    - flood
  - Lack of adequate road management
    - survey, asset data, skills, equipments, materials, personnel
    - about 80% of roads deteriorated
    - 37% of bridges needs major repair
  - Lack of adequate funds for road construction, maintenance, rehabilitation

Background Information
- Damage and Loss on Infrastructure

- Flood damage in West Guadalcanal

Loss of clearance due to debris

Scouring due to river flow

Loss of approach due to widened river flow

Deterioration and damage of bridge structures

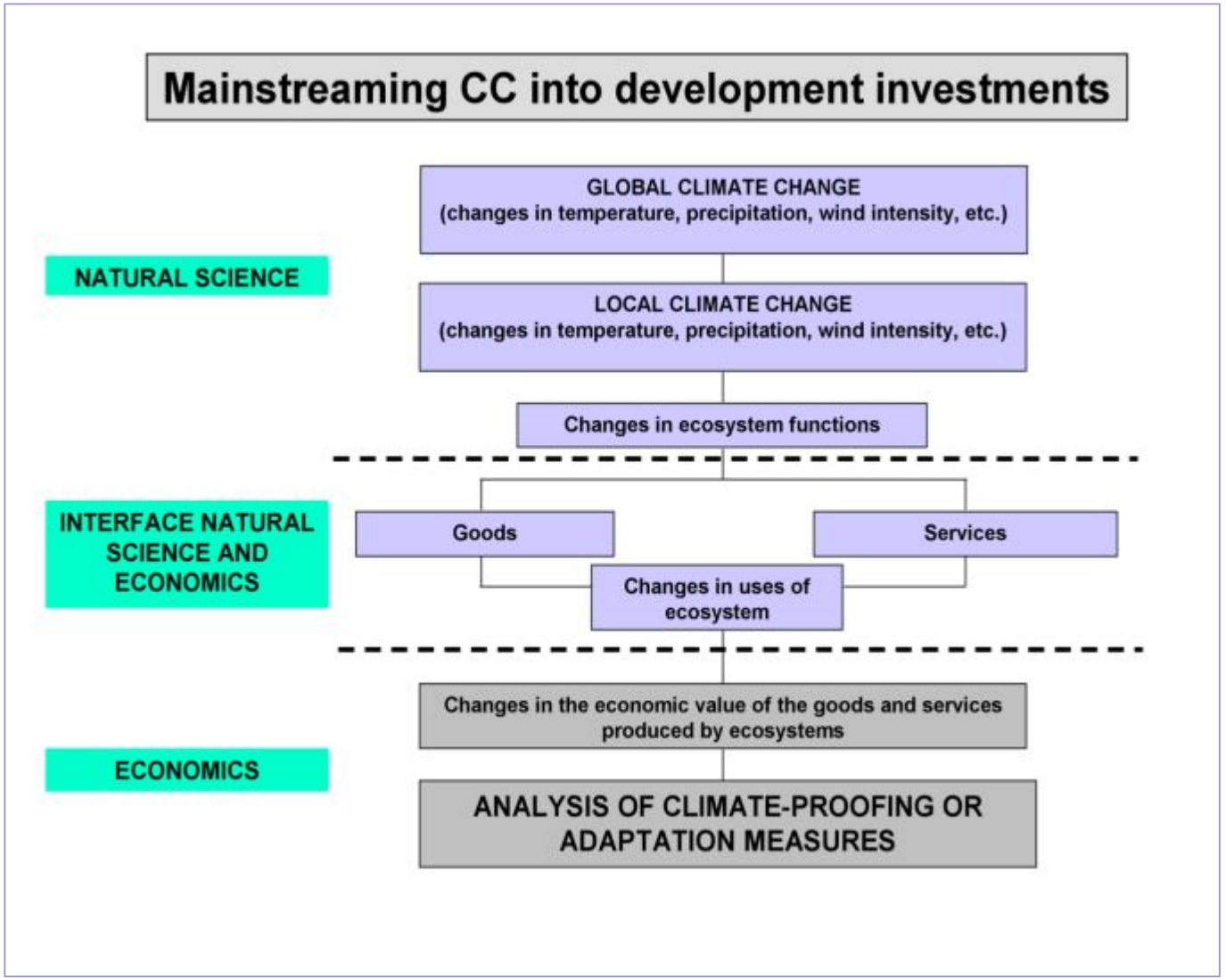
Background Information
- Projects

- Solomon Islands Road Improvement Project (SIRIP 1), 2006
  - $19.4 million from Governments of Australia, New Zealand, and Solomon Islands, and ADB
    - Improve the Solomon Islands' road network
    - Rehabilitate/upgrade 100 km of rural roads and roughly 40 bridges and stream crossings
- Second Solomon Islands Road Improvement Project (SIRIP 2), 2010
  - $24 million from Governments of Australia, New Zealand, and Solomon Islands, European Commission, and ADB
    - Provide continued support the objectives of SIRIP 1
    - Repair the infrastructure damaged by the Feb 2009 floods in Guadalcanal
  - $0.64 million additional cofinancing from Gov. of Australia and New Zealand
    - Restore temporary connectivity in Guadalcanal
  - Conduct climate change assessments, followed by the development of adaptation measures for the sub-projects of SIRIP 1

Climate Change Adaptation
- Strategies

- Two strategies are necessary to reduce the risks of climate change:
  - Mitigation
    - the causes of climate change are removed by reducing GHG emissions. "***Avoid the Unmanageable****…"*
  - Adaptation
    - the effects of climate change are dealt with by coping with their negative impacts, "***Manage the Unavoidable…****"*

Climate Change Adaptation
- Process



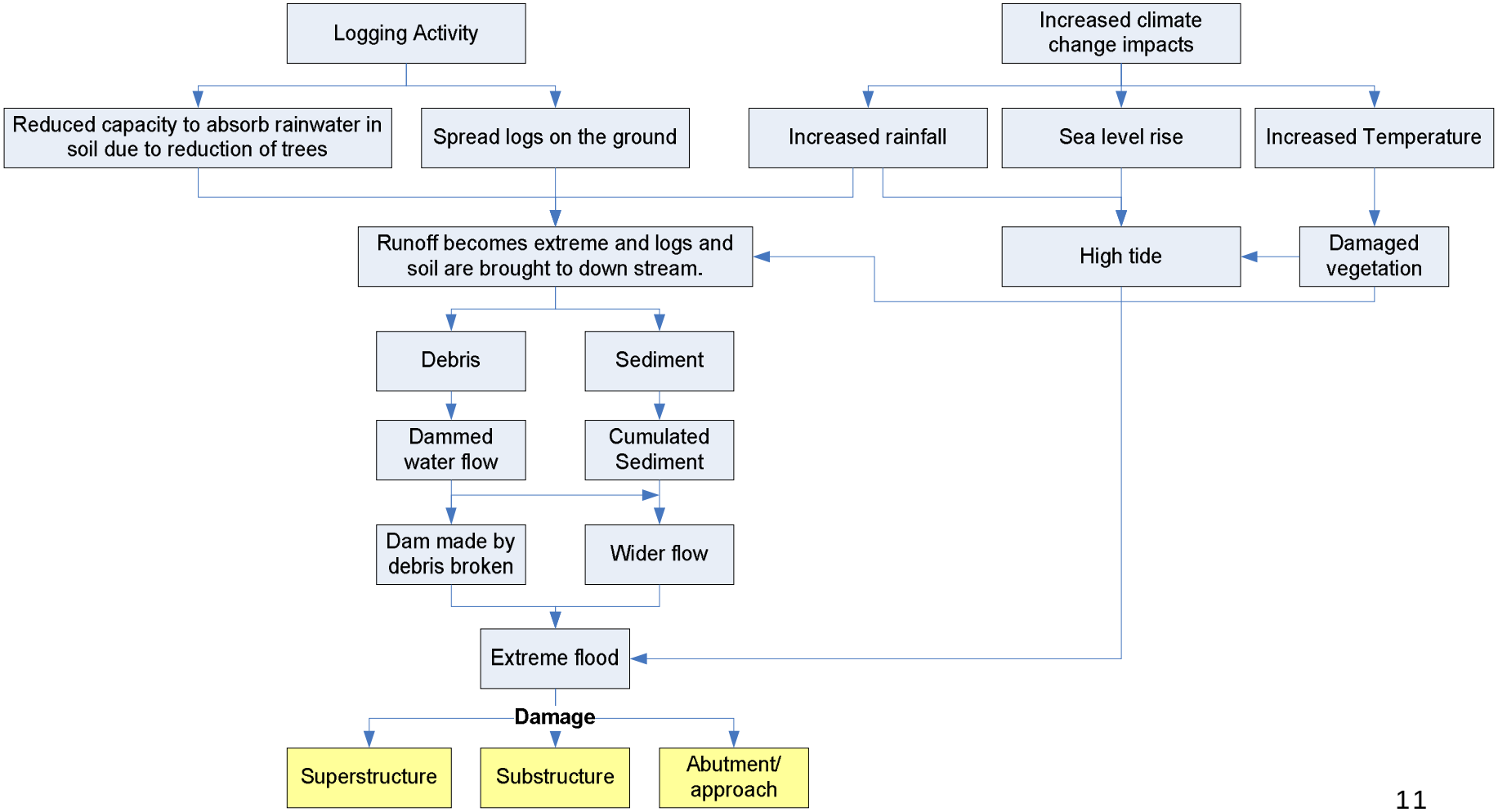
Climate Change Adaptation
- Approach

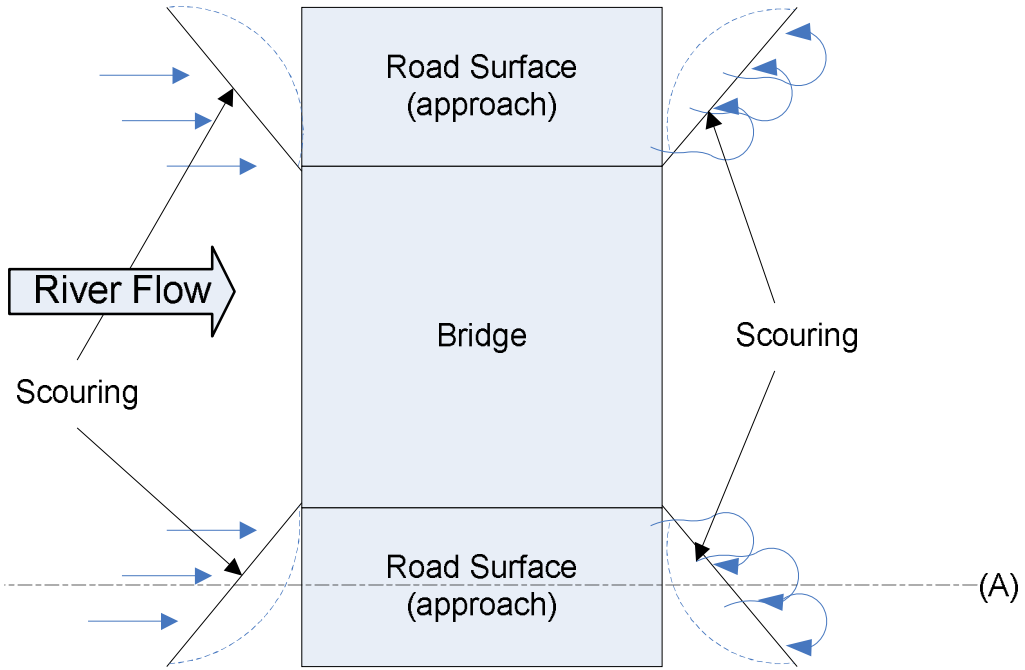
- Identify the climate change parameters of concern to the project need.
  - e.g., more concerned with the occurrence of peak rainfall events rather than annual averages
- Interpret modeling outputs through a field based vulnerability assessment and review of adaptation options.
  - A scenario driven impact assessment on its own is not sufficient to make recommendations on project design.

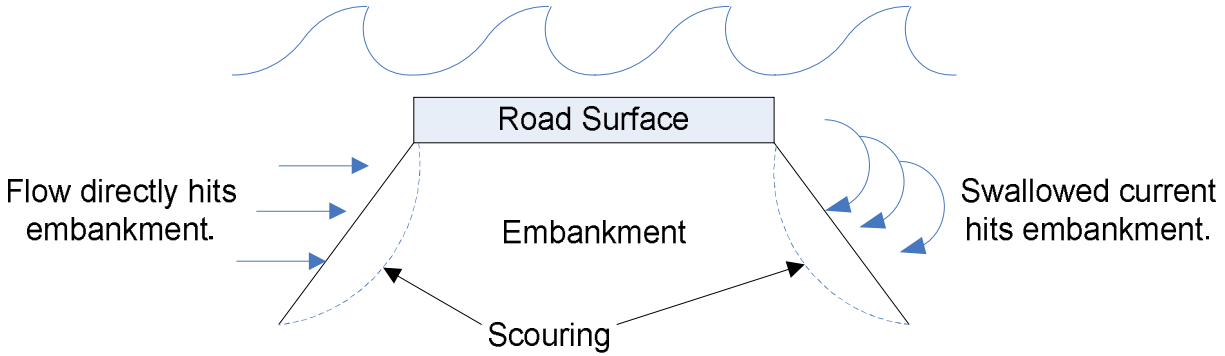
Risk Assessment for Climate Change

- Small islands
  - **vulnerable** to the impacts of climate change
- Low level of development and reliance on **climate dependent agriculture**
  - climate change impacts can be far-reaching.
- Transportation infrastructure located in areas
  - **highly sensitive to climate change**
  - currently **at risk** from **frequent up-land landslides during the rainy season** as well as from **flooding and inundation** due to sedimentation and subsequent reduced capacity of rivers and flood plains.

Vulnerabilities and Root Causes for Damages




Road Surface
(approach)
River Flow
Bridge
Scouring
Scouring
Road Surface
(approach)
(A)


Road Surface
Flow directly hits
embankment.
Embankment
Swallowed current
hits embankment.
Scouring

Side View (A)

Climate Change Patterns

Indicator	Tendency in South Pacific	Observation in Solomon Islands
Sea level rise	■0.19 to 0.58 m between (1980-1999) and the end of 21st century (2090-2099) ■Increased extreme wave height probability of occurrence and intensity along coastal regions	■A home was relocated due to flooding from waves during high tide. ■Tides were becoming extreme and encroaching inland.  Malaita Province, Galelle Village, Northern Road
Temperature	■Consistent warming trends in all small-island regions over 1901 to 2004 ■Annual and seasonal ocean surface and island air temperature have increased by 0.6 to 1.0°C since 1910. ■More frequent hot days and heat waves in the future	■Since 1960s, maximum temperature has increased by between 1 and 2 degrees, which is higher than the global average and enough to increase the severity of cyclones and to further damage vegetation.  Malaita Province, Ontong Java

Climate Change Patterns (cont'd)

Indicator	Tendency in South Pacific	Observation in Solomon Islands
Precipitation	■Models simulate only a marginal increase or decrease (10%) in annual rainfall.	■Increase in intensity and length during wet season, decrease during dry season  Malaita Province, Sikaiana
Extreme events	■Small islands to the east of the dateline are highly likely to receive a higher number of tropical storms. ■More than doubling in the number of category 4 and 5 storms from the period 1975-1989 t the period 1990-2004. ■Increased flood intensity and frequency	■Intensity of land slides up-stream and debris deposits down-stream at river crossings destroying infrastructure and food crops.  Guadalcanal Province, West Road

Climate Change Adaption Options – Engineering Response

- **Raise bridge decks** to Q10 - Q100 flood level and build high level bridges.
- Provide **extended river training measures** (protective groins) and embankment stabilization near villages as well as **debris capturing structures** up-stream of major river crossings.
- Where road sealing is proposed, **re-size roadside and cross drains**.
- **Re-sheeting roads** to a **raised level** (i.e., 500mm above current level).
- **Re-align** (major/minor) road sections prone to coastal erosion further inland.
- Provide additional **coastal protection structures** for coastal roads and bridges under threat of erosion/inundation in future.

Climate Change Adaption Options – Non-Engineering Response

- "No regret" or "Low regret" adaptation activities
  - ideally a "win-win-win" situation for mitigation, adaptation and sustainability by increasing land cover or coastal buffers and adding carbon storage capacity
  - Relatively inexpensive, flexible, and reversible
- Increase adaptive capacities when facing more uncertainty
  - e.g., higher efficiency in water retention during wetter periods, reducing risks of flooding and landslides
- Implement along with the road construction schedules or ahead as they will be located outside the road works area
  - e.g., mangrove re-planting and re-forestation in upper catchment
- Include community implemented programs leading to success
  - e.g., community maintenance programs