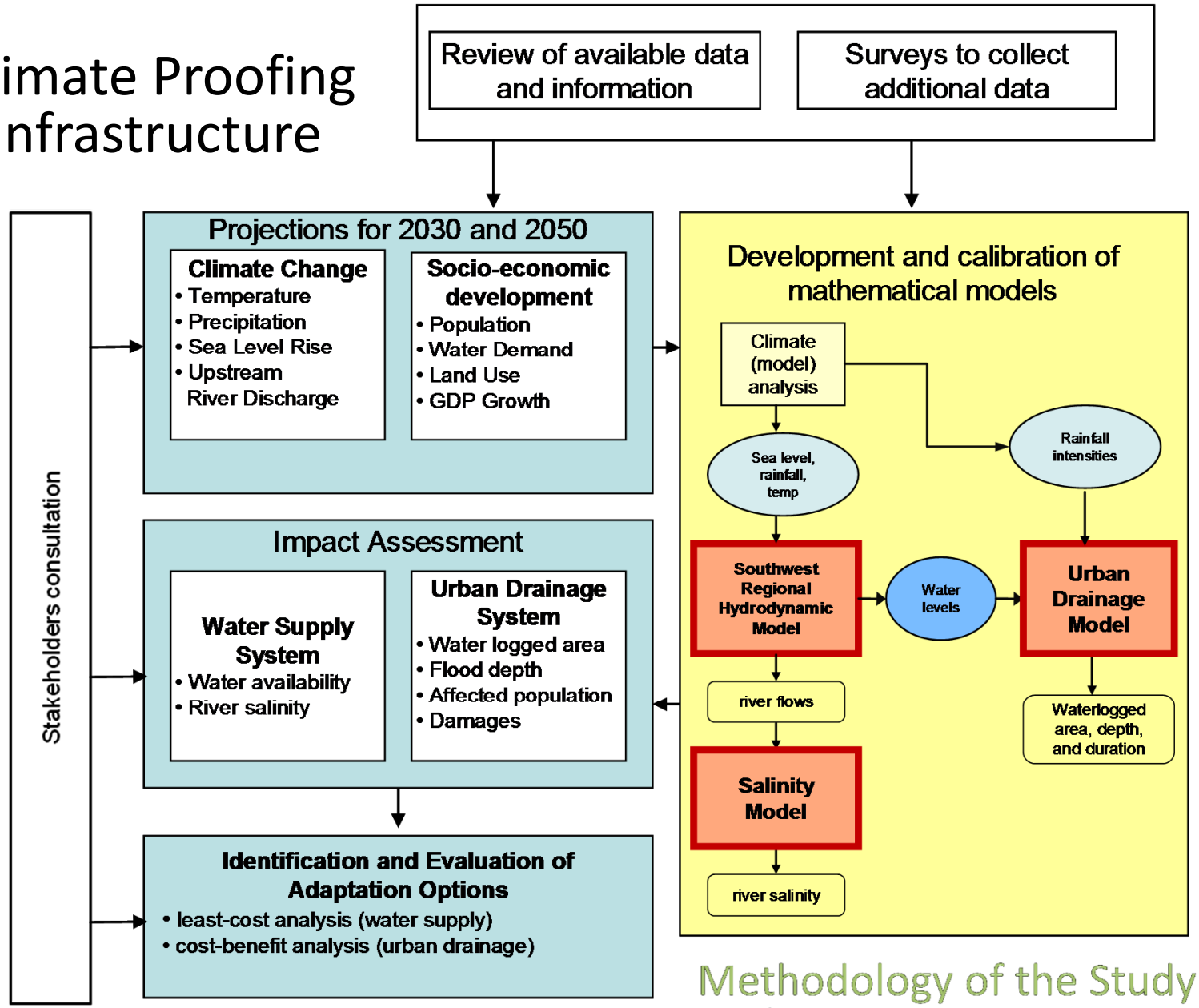
Climate Proofing Infrastructure



Methodology of the Study for Khulna, Bangladesh

Impacts on Water Supply System

- Water availability will not be a major concern in 2030 and 2050 even in dry season.
- Salinity will significantly increase in proposed water intake points.

Adaption options

- Core options: (a) relocate the proposed intake point upstream by 4 km by 2050; (b) increase the impounding reservoir size by 12 million m^3 by 2050, with the same intake point
- Add-on options: (a) water demand management; (b) reduction of non-revenue water

Adaptation Options	Economic	Social	Environmental
Option 1. Relocate the intake point upstream by 4 kilometers from Mollarhat by 2050.	**Investment cost.** $8.39 million **O&M cost.** $24,000 per year	16 households affected, no resettlement	Construction impacts (noise, vibration)
Option 2. With an intake point at Mollarhat, increase the reservoir size by 12 million m^3 by 2050.	**Investment cost.** $29.04 million **O&M cost.** $28,000 per year	More than 20 households affected, including resettlement	Construction impacts (noise, vibration)

Impacts on Urban Drainage System

- Existing drainage system is insufficient even with no climate change in the future (i.e. adaptation deficit).
- Waterlogging will be increasingly severe in 2030 and 2050.

Adaption options

- Core options: a combination of widening/deepening existing drains, laying new drains, river dredging and sluice gates
- Add-on options: (a) good solid waste management; (b) awareness and education campaigns, (c) strict implementation of building codes and urban planning measures, and (d) early warning system

Table 10: Cost of Drainage System Improvements for Different Scenarios

	5-Year Return Period				10-Year Return Period			
	Investment Cost		O&M Cost per Year		Investment Cost		O&M Cost per Year	
Design Event	(Tk million)	($ million)	(Tk million)	($ million)	(Tk million)	($ million)	(Tk million)	($ million)
Base Improvement	493.0	7.0			751.0	10.7		
2030 Adaptation	64.0	0.9	24.4	0.3	39.0	0.6	15.0	0.2
2050 Adaptation	1,312.0	18.7	100.5	1.4	1,167.0	16.7	89.4	1.3

O&M = operation and maintenance.

Notes:

a. Adaptation investment cost for climate change is on top of drainage system improvement costs. Adaptation measures ensure that 80% of each ward is free from damaging floods.

b. Similarly, the adaptation O&M cost is on top of annual costs without climate change.

Conclusions and Lessons

- Specific adaptation options can be proposed and their costs and benefits estimated, by using the future climate scenarios and well-developed mathematical models.
- Uncertainties are large: It is important to consider phased-development/adaptive management while strengthening the monitoring.
- Assess nature of investment/adaptation measures: (i) invest now if benefits are expected even under the current climate (no/low regret); or (ii) invest later if incremental investment will not result in additional costs and the investment can be made quickly.
- Other changes than climate may have far-reaching impacts on the sustainability of infrastructure.

Challenges

- Unavailability of downscaled data in many developing countries
- Decision-making under uncertainty
- Practical case studies (and implementation) still very limited
- Collaboration among climate change scientists, engineers, and economists
- Sophisticated approach vs. quick assessment
- Complementarity (i) between engineering and non-engineering options and (ii) between top-down and bottom-up approaches