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The Development of Guidelines for Hydropower Environmental Impact Mitigation and Risk Management in the Lower Mekong Mainstream and Tributaries (ISH0306)

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Multiconsult

Deltares
Enabling Delta Life
Delft Hydraulics

BOKU

I H G

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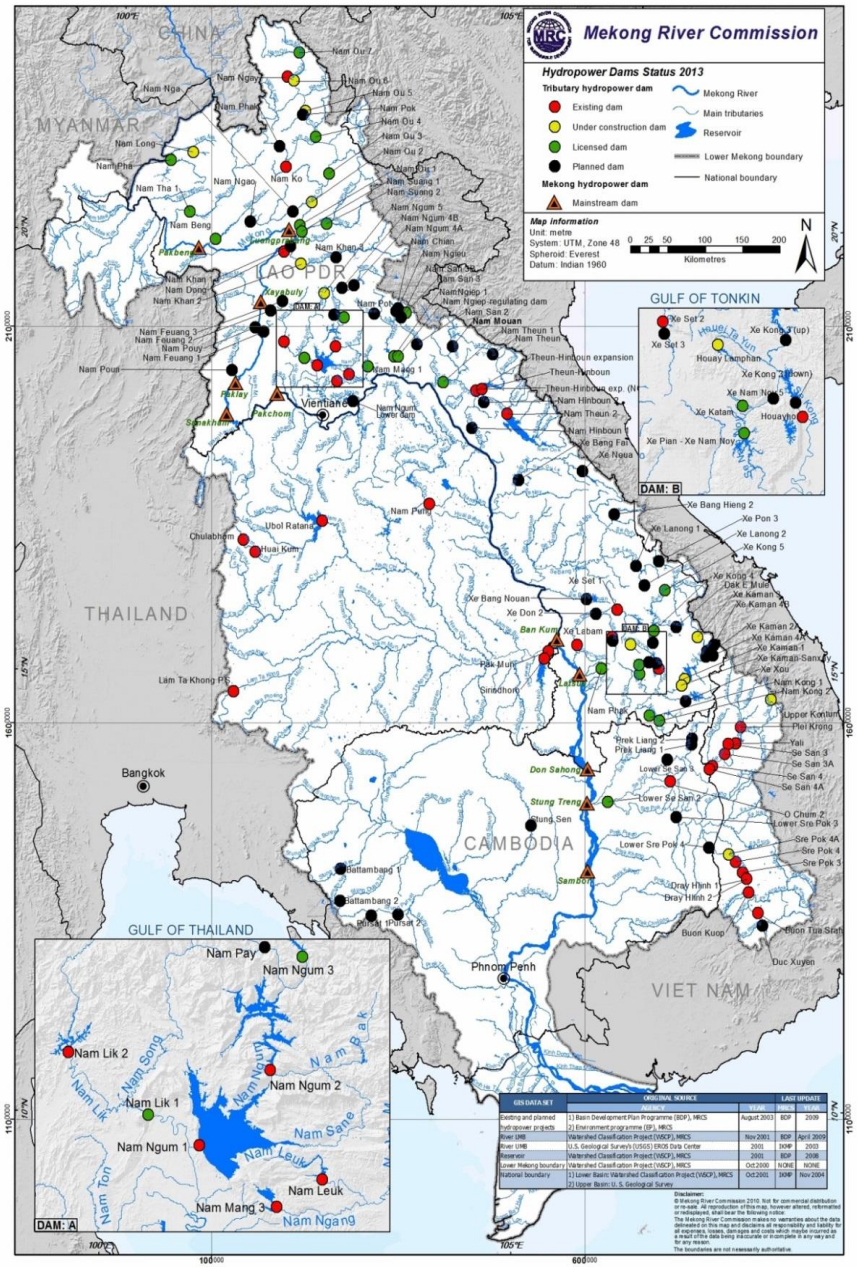
Existing and planned hydropower projects



Introduction - Study objective

Providing **measures, GUIDELINES and good industrial practice** and state of the art insight into the sustainable development of hydropower in the Lower Mekong Basin. By linking it to the Mekong 1995 Vision

"an economically prosperous, socially just and environmentally sound Mekong River Basin"

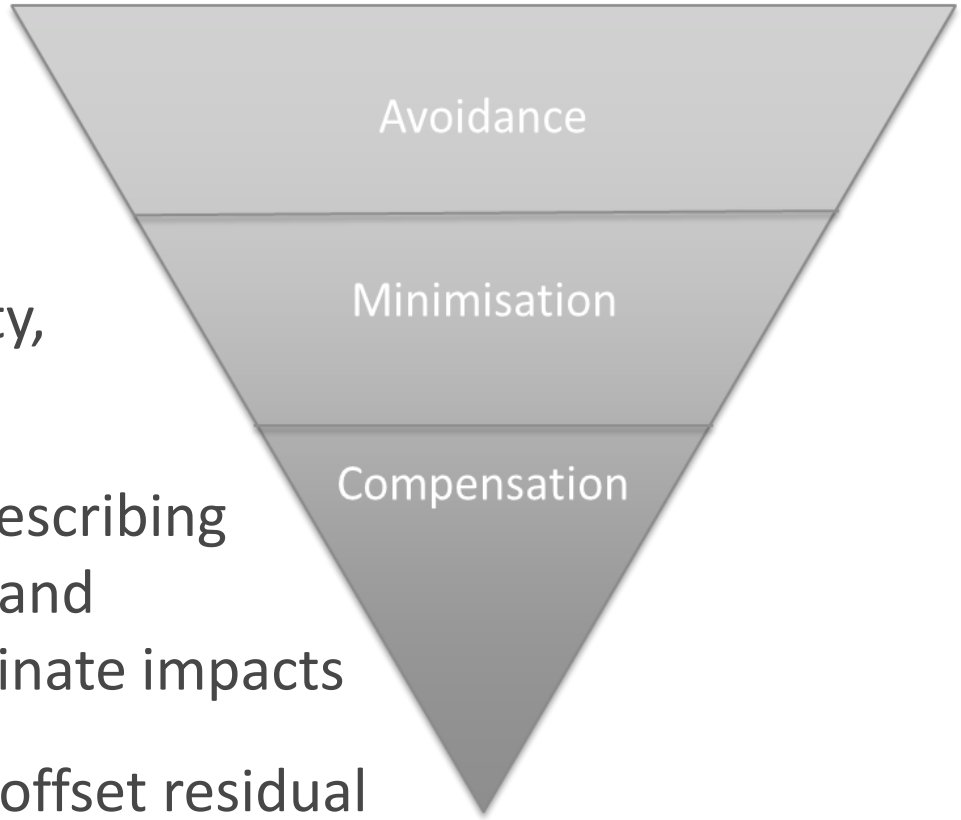
Assessment in LMB, UMB, GMS and Internationally

Mekong overview

Process for for Risk and Impact Mitigation Assessment

Article 7 – Mekong Agreement (1995) «*To make every effort to avoid, minimize and mitigate harmful effects……*»

Mitigation Hierarchy



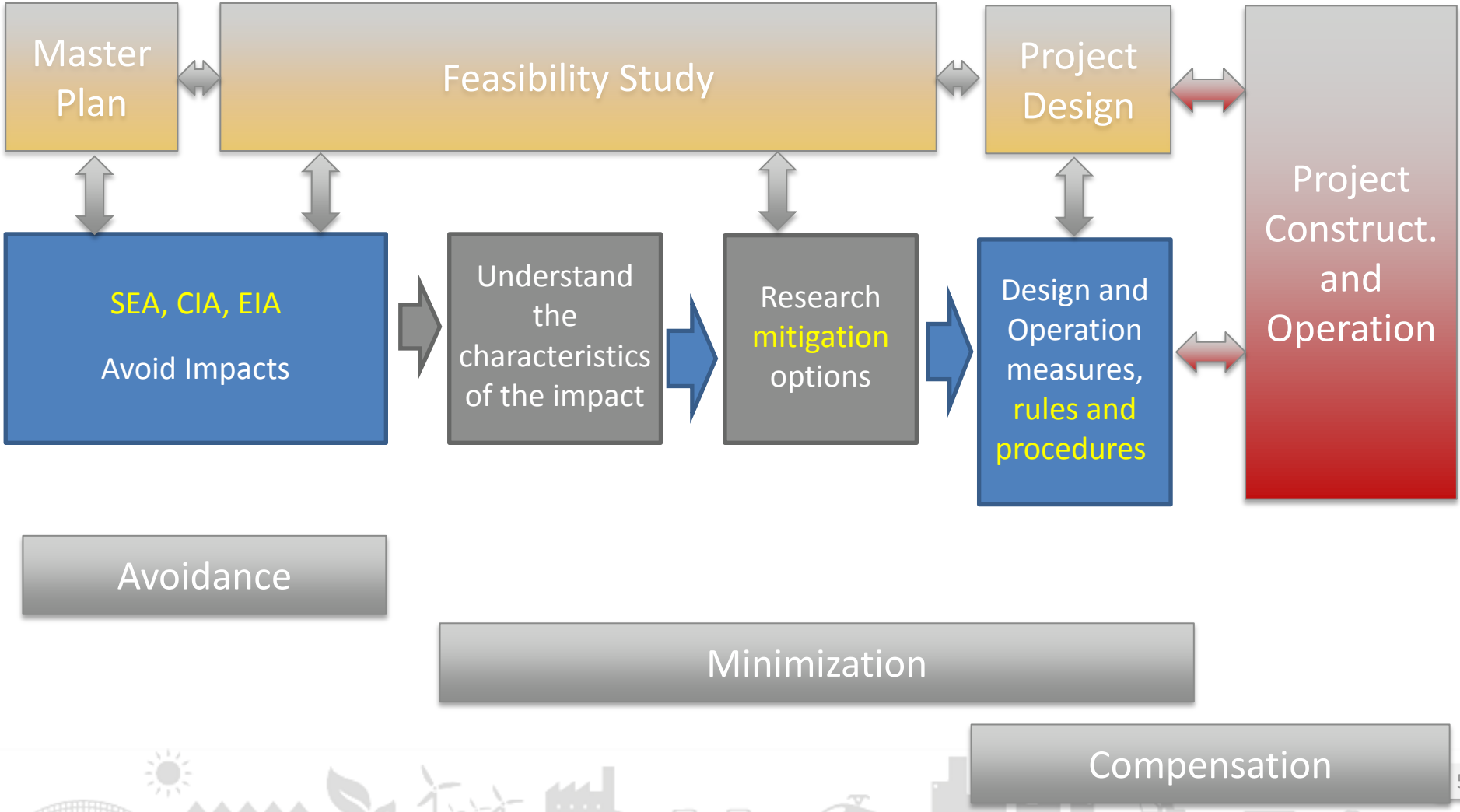
Avoidance = Identifying alternative sites or technology to eliminate Impacts (Master plans, Pre-feasibility, Feasibility)

Minimization = most often used prescribing actions during design, construction and operation stage to minimize or eliminate impacts

Compensation = used to restore or offset residual impacts identified at different stages

Process for Risk and Impact Mitigation Assessment

MRC Generic Practical Process for Risk and Impact Mitigation - Project Life Cycle



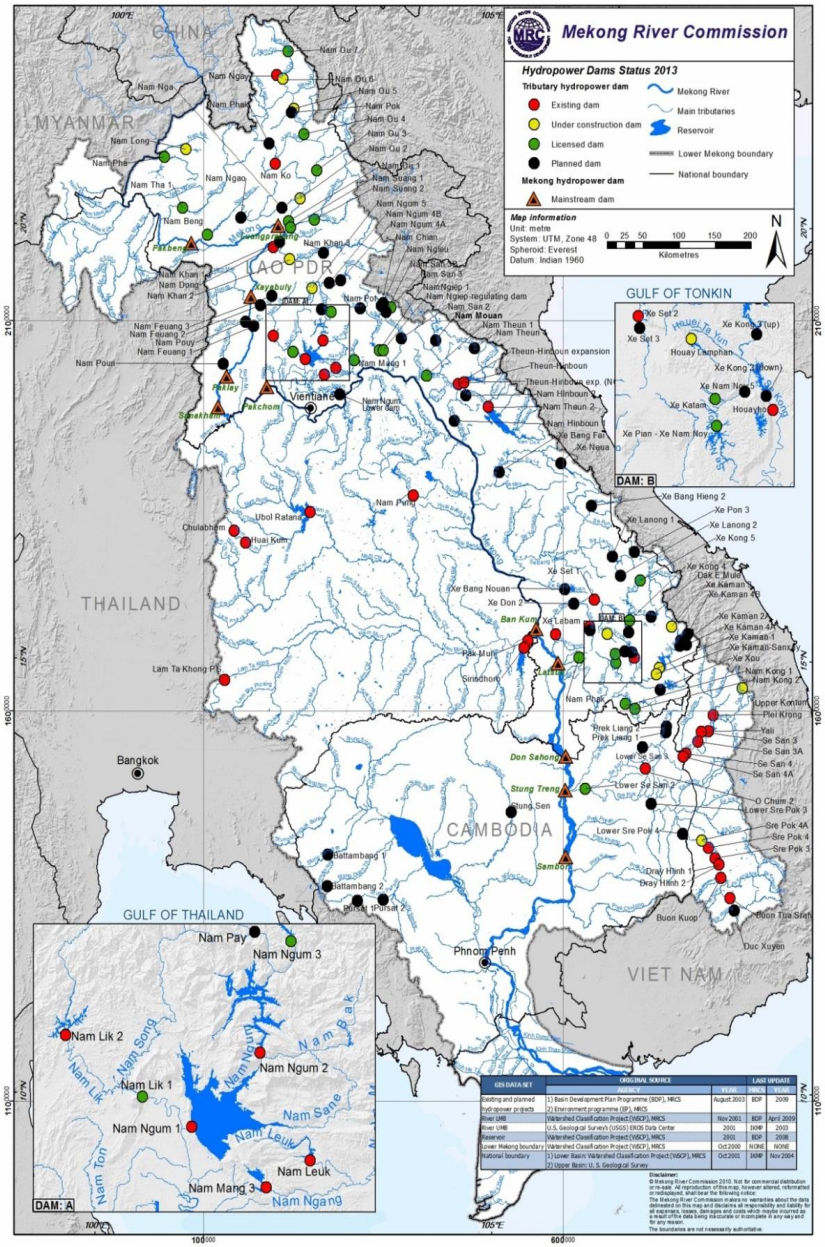
Study Scoping and Planning

Geographic Scope

Twofold:

1) A general assessment at the basin level for the Lower Mekong, including its tributaries

Existing and planned hydropower projects



Study Scoping and Planning

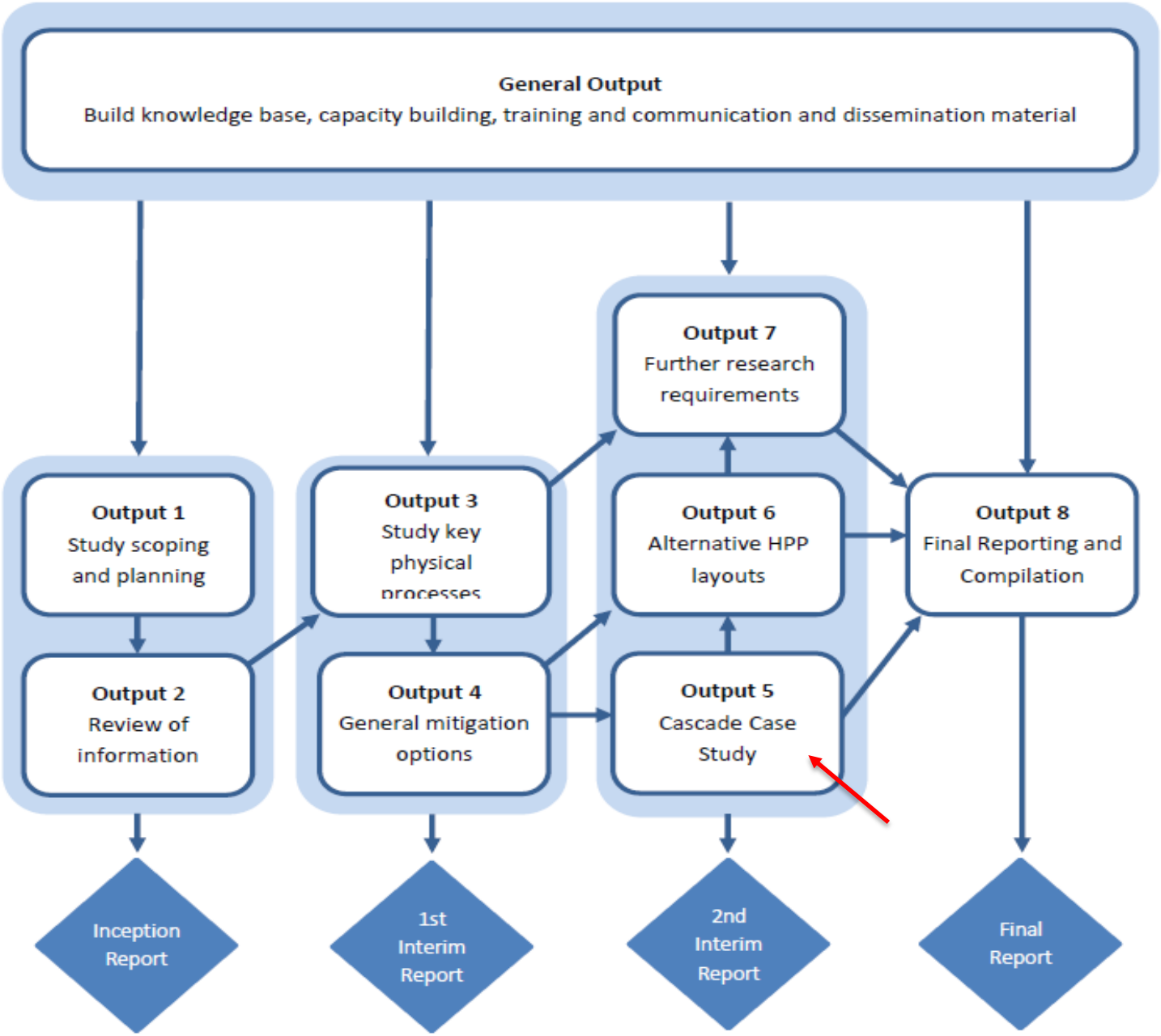
Geographic Scope

Twofold:

2) A more detailed assessment of the 6 mainstream cascade dams planned to be constructed in Lao PDR 5 (6) hydropower plants:

- Pakbeng
- Luangprabang
- Xayaburi
- Paklay
- Sanakham
- (Pakchom)

Main Activities with outputs



1st version Guidelines

2nd version Guidelines

Final Guidelines

Overall Framework for the Hydropower Risks and Impact Mitigation Guidelines and Recommendations

Overall Guiding Principles
(Mekong 1995 Agreement supported by Strategic Planning Guides and PDG)

- International Policies and Safeguards
- Cooperation on International River Basins
- Robust Governance Base line data informs decisions
- Multidisciplinary approach
- Engage stakeholders – protect rights and entitlements
- Equitable share benefits and costs
- Address Poverty and Food Security
- Maintain Basin wide ecosystem integrity

Guidelines and recommendations for planning, design and construction of new hydropower

Guidelines and recommendations for operation of existing and new hydropower

General Mitigation Options (including impacts, risks and vulnerabilities)

- Theme
- Project life cycle

Mitigation Guidelines and Recommendations

Focus Themes (First Version of Guidelines):

1. **Hydrology and downstrean flows**
2. **Geomorphology, sediments and water quality**
3. **Aquatic ecology and fisheries; and**
4. **Biodiversity, natural resources and ecosystem services**

Related to:

Key Risks, Impacts & Vulnerabilities
1. Annual / inter-annual changes to flow
2. Daily / short-time scale changes to flow and water level
3. Loss of river connectivity
4. Impoundments
5. Diversion scheme / inter basin transfers

Mitigation Guidelines and Recommendations

Key Changes Related to Hydropower Development	Key Risks, Impacts and Vulnerabilities by Thematic Area	Potential Mitigation Approach/Strategy	
		Planning / design / construction	Operation
1. Annual / Inter Annual changes to flow			
2. Daily / short-time scale changes to flow and water level			
3. Loss of river connectivity			
4. Impoundments			
5. Diversion scheme / inter basin transfers			

Basic architecture for final output

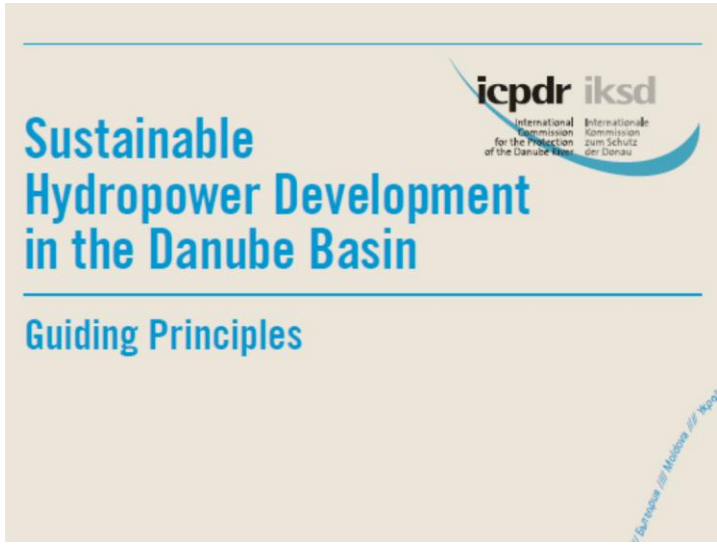
Hydrpower Risks and Impact Mitigation Guidelines, Manual and supporting Knowledge Base (KB)

1. Hydropower Risks and Impact Mitigation Guidelines and Recommendations (previous slides)

- Will also include description of suitable stakeholder involvement during the different phases of the HPP project cycle.

2. Manual (Plannng Kit) to support implementation of Guidelines

- Manual overview
- Approach on how to choose the most tailored and right mitigation options for and linkage to KB
- Examples and experiences of good industrial practice Description of what kind of broad type of models is needed
- Needs for capacity building and training.

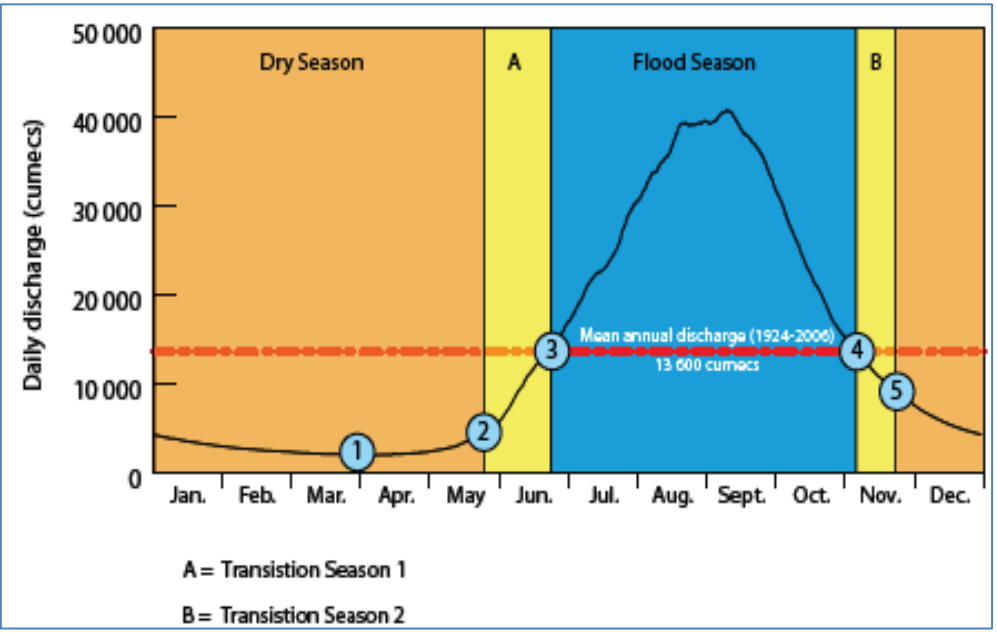


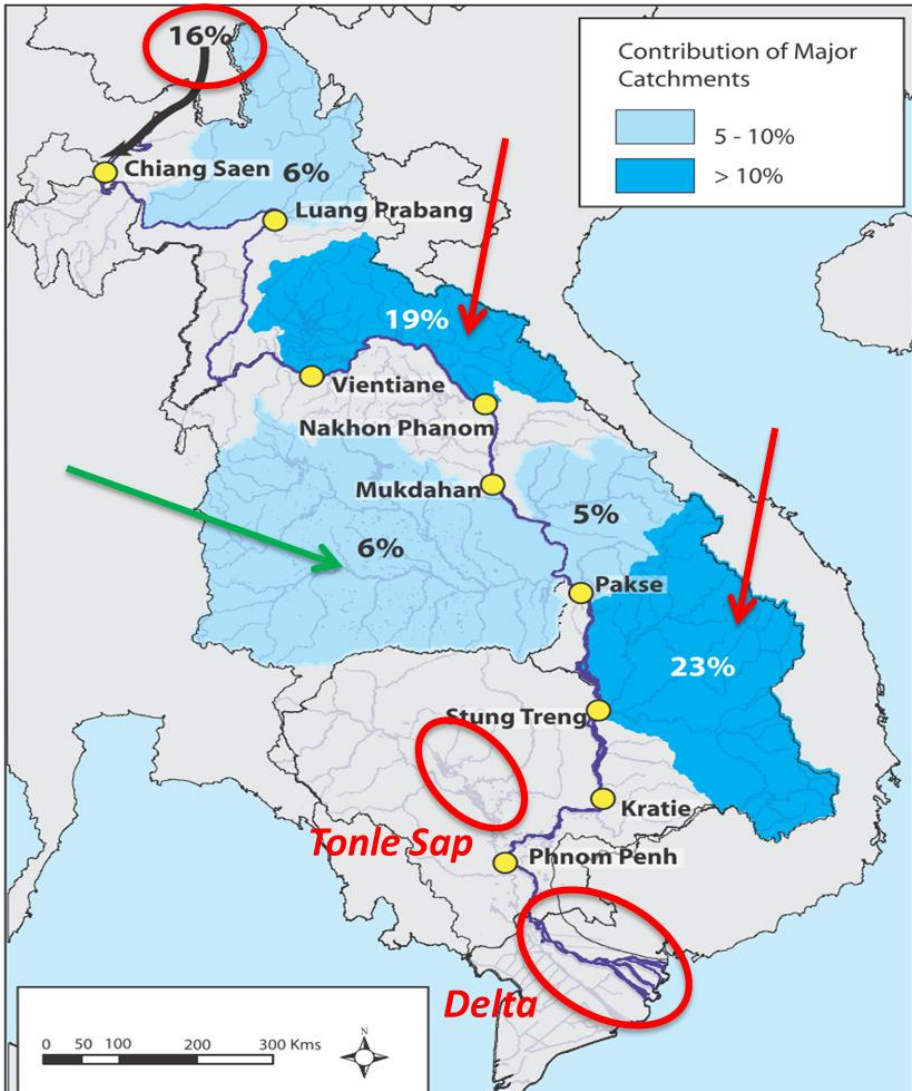
Example Guidelines Transboundary river basin

3. Knowledge Base

Example Mitigation Guidelines and Recommendations

Details from Supporting Manual – Risks, Impacts and Mitigation





Overall flow regime (left) and main contributions to annual flow (right)

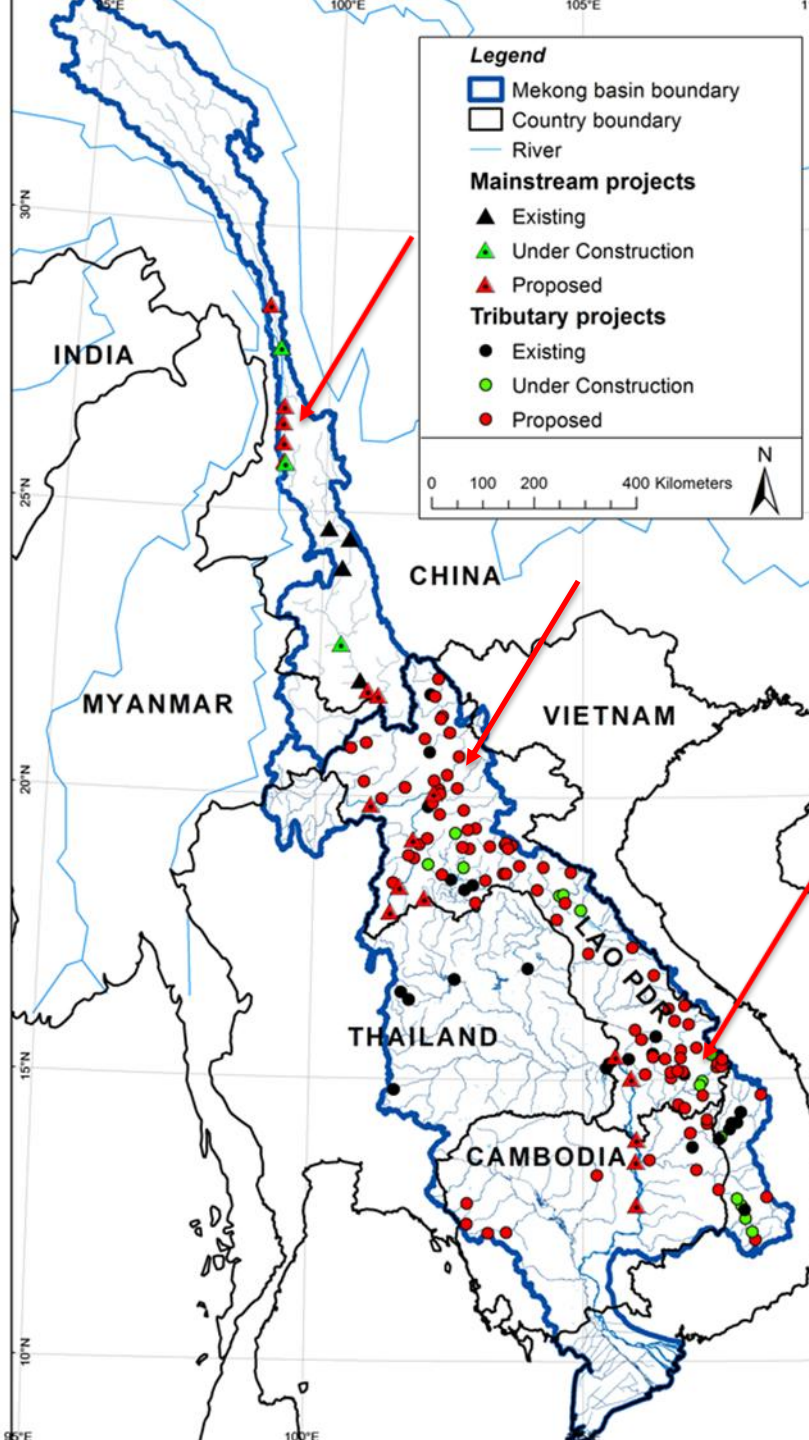
Example Mitigation Guidelines and Recommendations

Details from Supporting Manual – Risks, Impacts and Mitigation

1. Flow Changes – The Big Picture

Most likely vulnerabilities for flow changes

- 1. Tonle Sap
- 2. Cambodian floodplains (levels and velocities)
- 3. Mekong Delta (salinity intrusion, sediment, …)
- Flow vulnerabilities themselves are not the prime interest → ***always connected to impact on fisheries, ecology and sediment***



Expected changes - UBM and tributary storage

Peak flows decreased and lower annual flood volumes

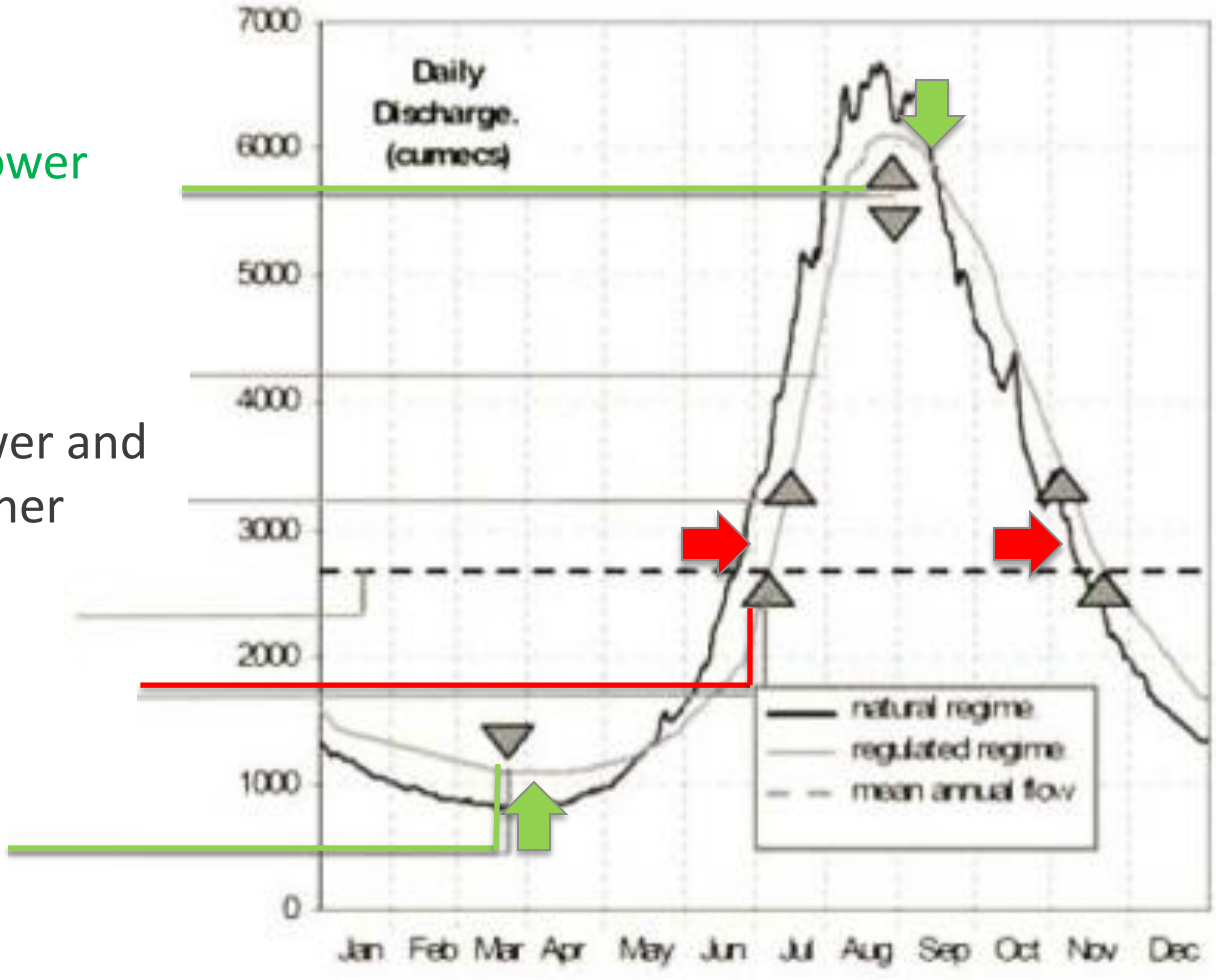
Overall annual hydrograph "smoother"

Early flood season flows lower and later flood season flows higher

Mean annual discharge unchanged

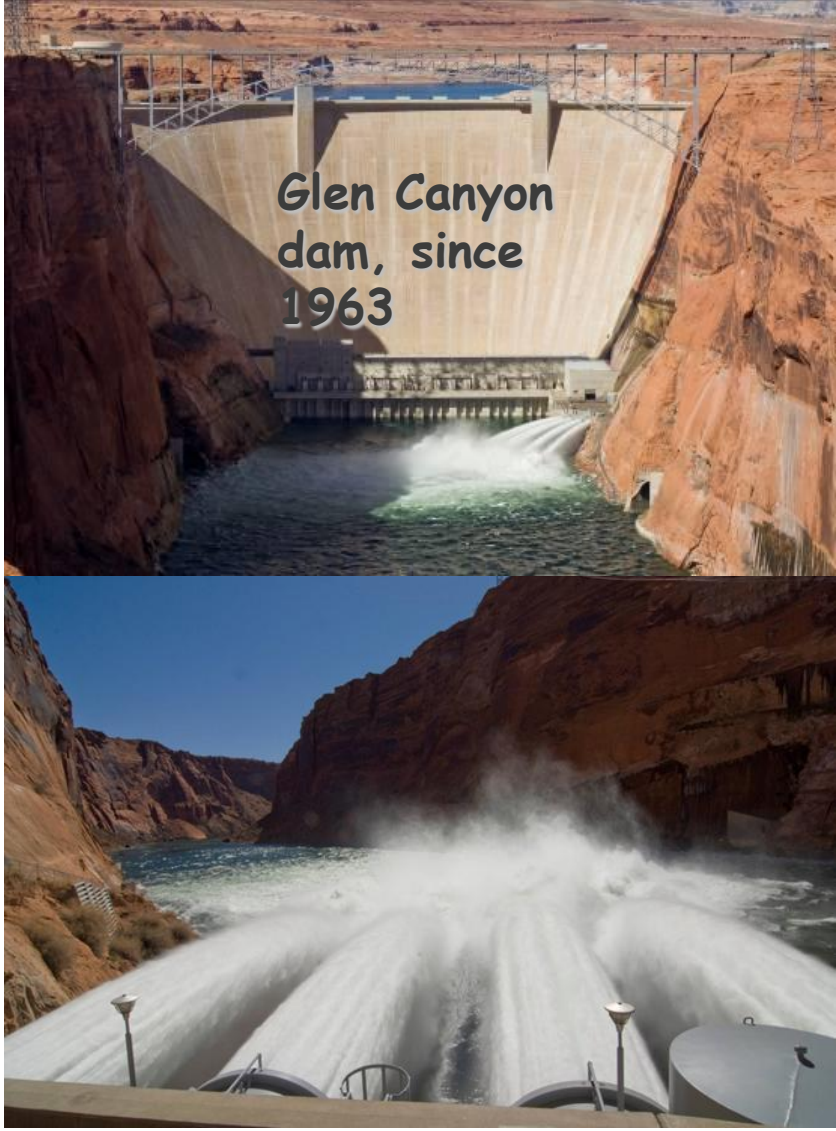
Later start and end of flood season conditions

Increased dry season flows



Mitigation guideline artificial floods

- Bring back some of the natural flow dynamics by releasing flood pulses
- Based on hydrological indicators, environmental indicators
- Requires large-scale planning when applied for the Mekong River: joint operation of tributary storage dams in Laos and Cambodia. Incorporate in Master Plans.

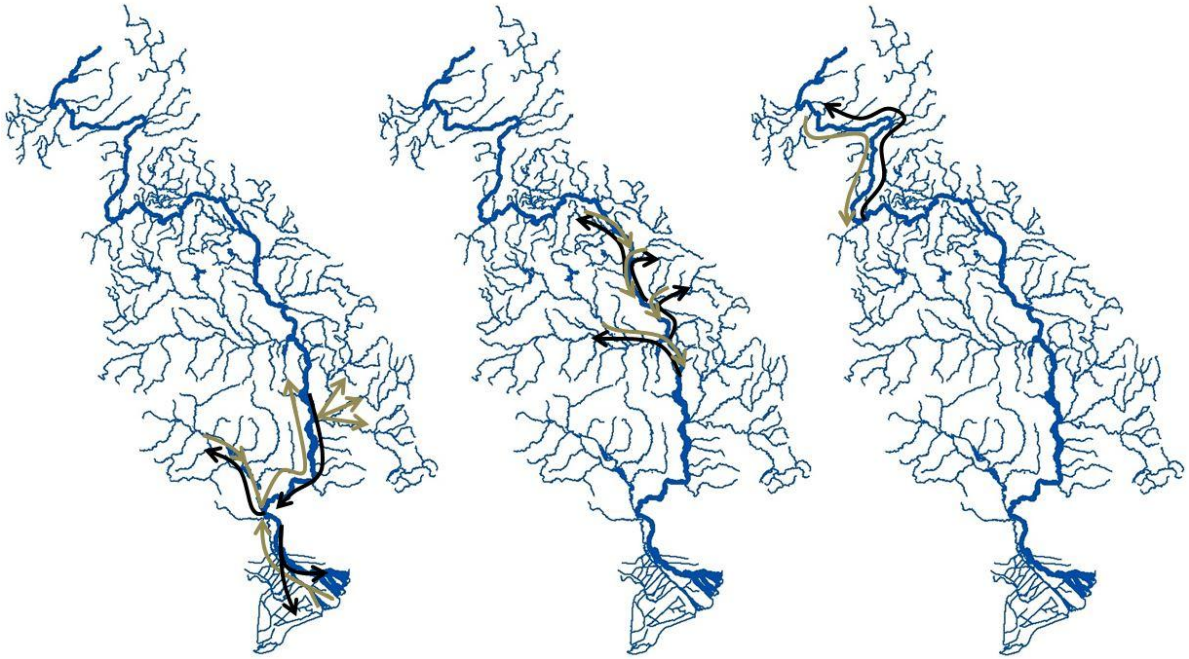


Reference: artificial floods to preserve sand bars in the Grand Canyon (USA)

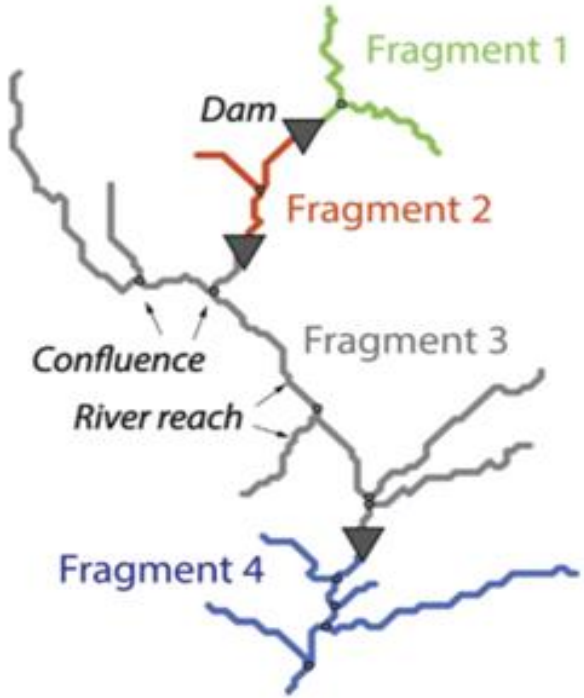
Example Mitigation Guidelines and Recommendations

Details from Supporting Manual – Risks, Impacts and Mitigation

Loss of Connectivity – Fisheries and Aquatic Ecology



Lower, middle and upper migration systems of LMB
Schmutz and Mielach, 2015



Grill et al., 2014

Connectivity restoration

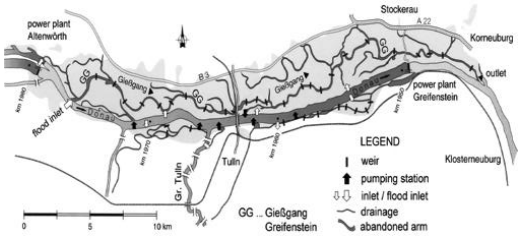
multiconsult.no

Upstream

Nature-like

Bypass channels &

Large scale bypass systems



Technical

Vertical slot

Downstream

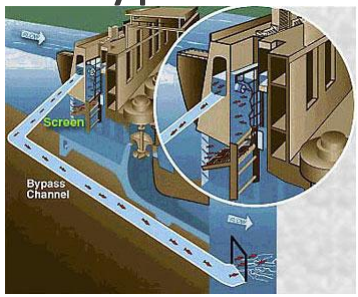
Fish protection

Screens

Fish-friendly turbines

Fish passage

Bypasses



Spill flow

Example of Guidelines (PDG) used in the assessment of Xayaburi – Mainstream Project

Design revised to respond to MRC Prior Consultation Process

Status in June 2015

(photo courtesy of Poyry Energy Ltd)

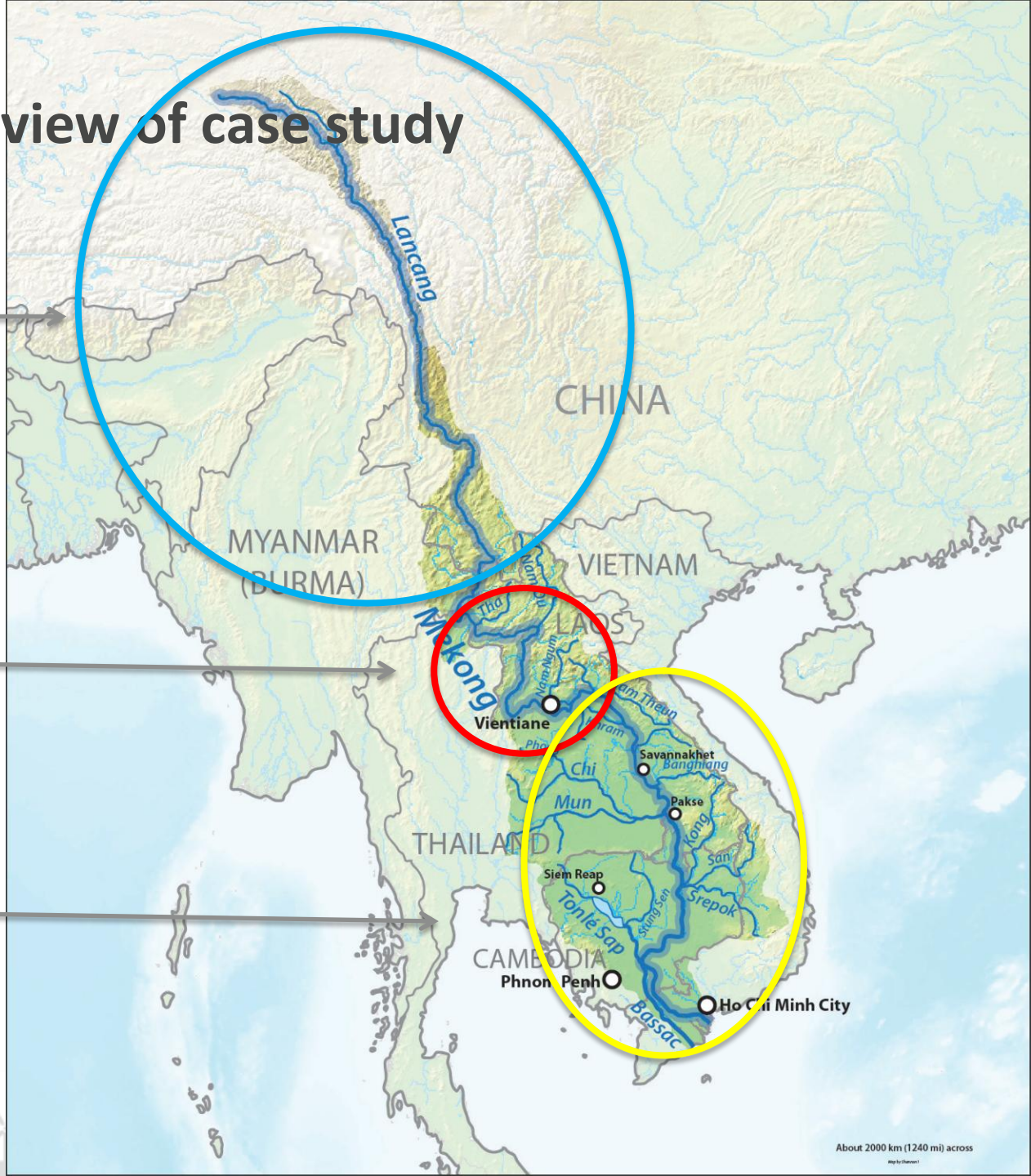
Case study details

Geographical overview of case study

Catchment & basin models (hydrology, sediment yield) & river-basin models

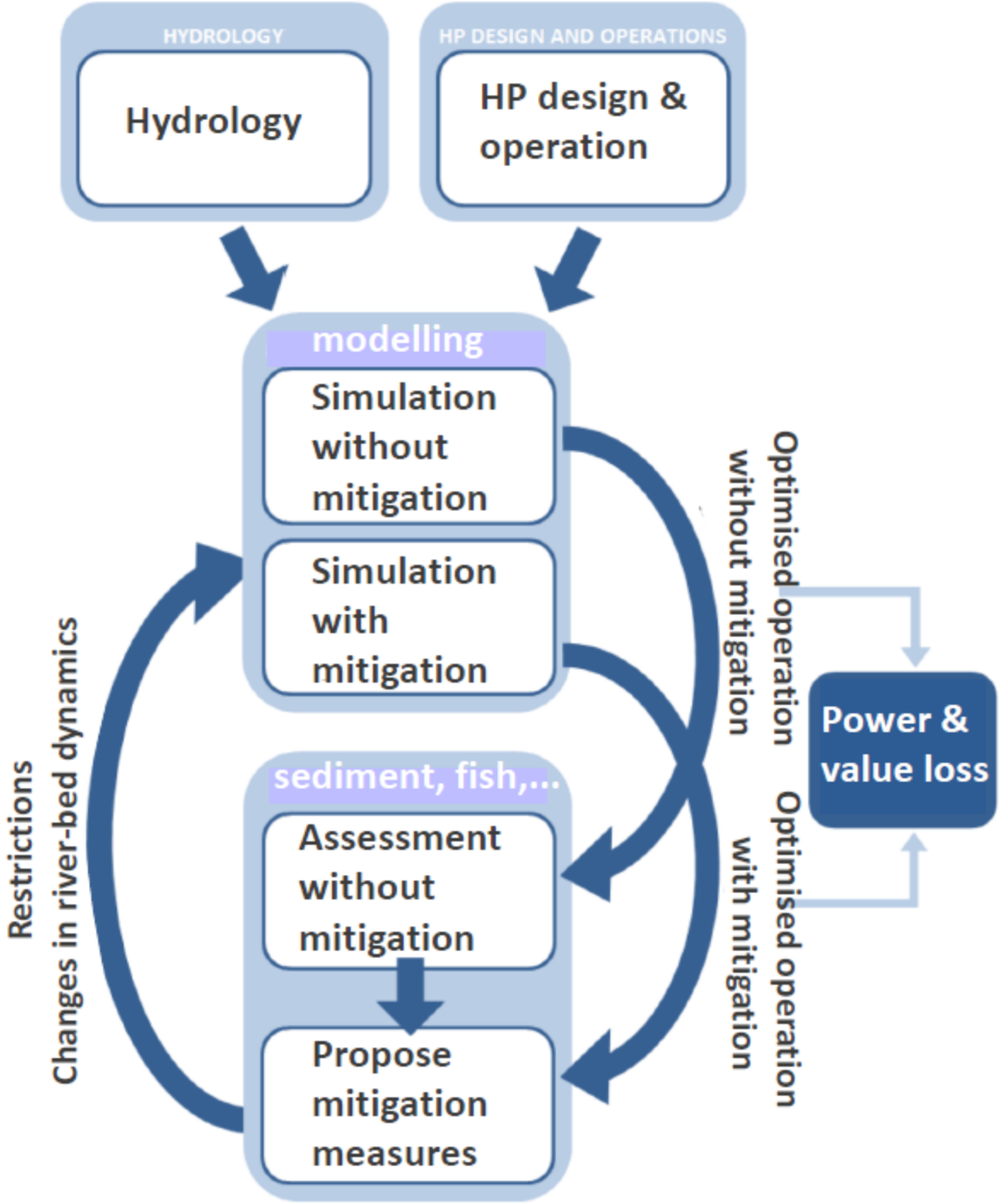
Detailed reservoir models (cascade), hydropower models

Downstream impacts (sediment, fish, water quality, Tonle Sap, delta)



Case study details

Test and support proposed hydropower mitigation guidelines and associated research recommendations




Thanks for your attention