WHAT IS CUMULATIVE IMPACT ASSESSMENT AND MANAGEMENT?

PABLO CARDINALE
ENVIRONMENTAL AND SOCIAL STANDARDS ADVISOR (SOUTH ASIA)
WORLD BANK
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Hydropower Developers' Working Group

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Why Assess Cumulative Impacts?

The major environmental and social management challenges that we face today – loss of biodiversity, the decline of ocean fisheries, desertification, or climate change - are all the result of cumulative impacts from a large number of activities that are for the most part individually insignificant, but which together have had global repercussions.

What are Cumulative Impacts?

- Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to as “developments”) when added to other existing, planned, and/or reasonably anticipated future ones.
- For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities.

“death by a thousand cuts”

Environmental And Social Risk Assessment Tools

TABLE 1. TOOLS FOR ENVIRONMENTAL AND SOCIAL RISK ASSESSMENT AND MANAGEMENT

Environmental and Social Impacts Assessment (ESIA)	• Applies to the potential impacts of a particular development proposal • Done in the context of a well-defined development proposal for which the construction and operational details of the development alternatives are known • May include an assessment of the project's contribution to a well-known accumulated impact and propose standard mitigation measures (e.g., greenhouse gas emissions, airshed pollution, depletion of wild fish stocks)
Strategic Environmental Assessment (SEA)[21]	• Relates to potential impacts of governmentwide or sectorwide policies, plans, or programs • Anticipates how instruments such as policies that are not specifically tied to a particular physical development may result in a variety of impacts at different times and places
Regional or Sectoral Impact Assessment	• Assesses the impacts of the potential developmental future of a geographic region or of an overall sector or industry (sometimes referred to as regional or sectoral SEA)
Cumulative Impact Assessment and Management (CIA)	• Assesses the ecological and social impacts that determine the status of environmental components and affected communities (VECs) • Requires consideration of past, present, and future projects and natural drivers that affect them • Assessment reflects the geographical and temporal context in which the effects are aggregating and interacting (e.g., airshed, river catchment, town, landscape)

Logical Framework:

- Scoping.
- Description of Environment and Social characteristic/ Potential Impacts.
- Determination of Consequences: Significance of Impacts.
- Effect/Impact Management: Mitigation Hierarchy: avoid, minimize, mitigate or compensate.

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ESIA vs CIA: Question of Perspective

18 5 41 9 1 76 3 22

Eighteen, five, forty-one, nine, one,
seventy six, three, twenty two

CIA : We use same tools as ESIA, same information, data, similar uncertainties, knowledge, BUT a different perspective

ESIA vs CIA

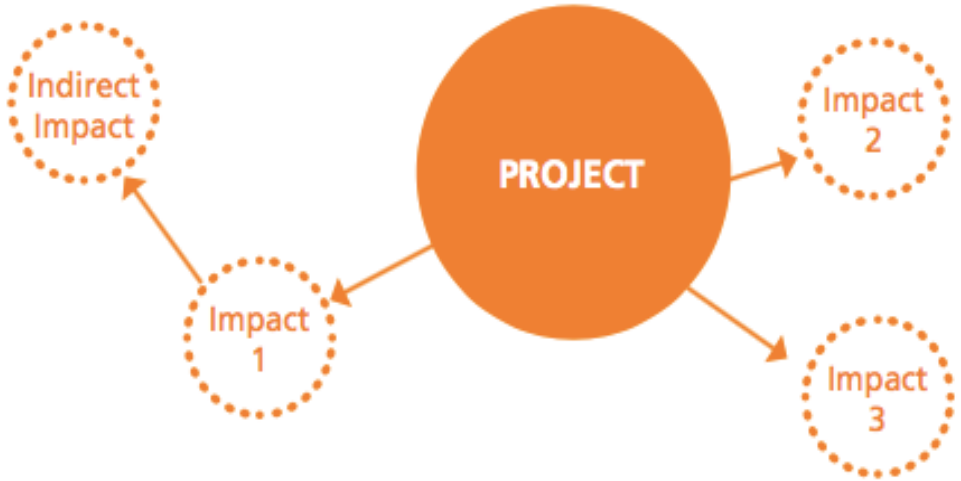
Basic Conceptual Assessment Paradigm Change

1. Focus: Project Impacts vs Condition of Valued Environmental and Social Components (VECs).

2. Scope: Expanded spatial and temporal boundaries for the analysis.

Environmental and Social Impact Assessment (ESIA)

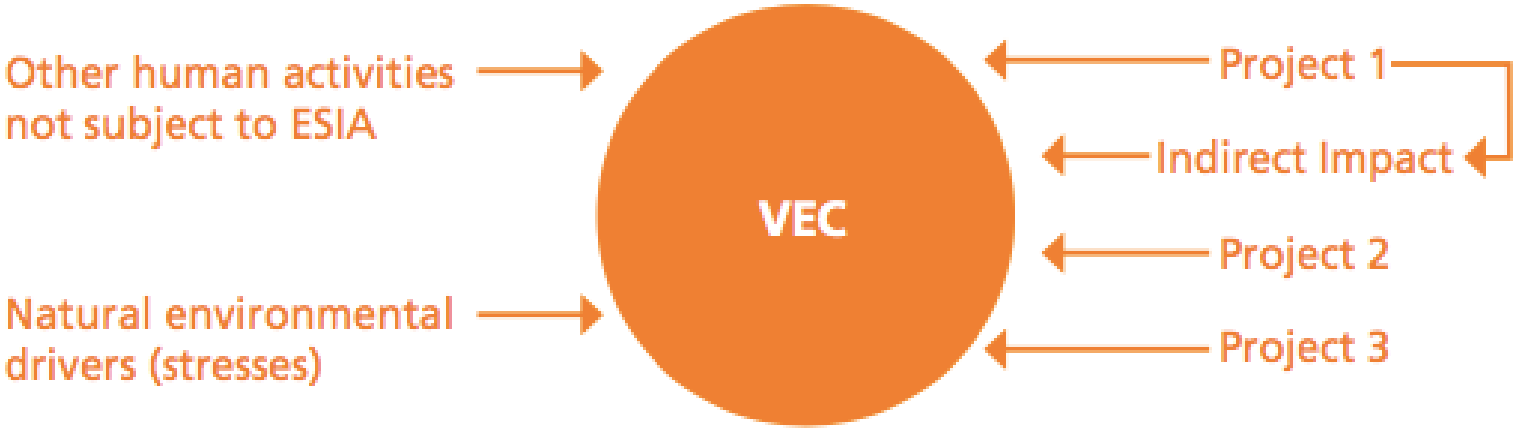
FIGURE 3. ESIA: PROJECT-CENTERED PERSPECTIVE



An ESIA describes the setting, impacts and mitigation actions for a SPECIFIC PROJECT

Cumulative Impact Assessment (CIA)

FIGURE 4. CIA: VEC-CENTERED PERSPECTIVE



CIA focuses on the valued environmental and social components (VECs) of the broader area, assessing how the VECs will be impacted under scenarios with current, planned and future development projects as well as other stressors. A wide range of VECs are assessed.

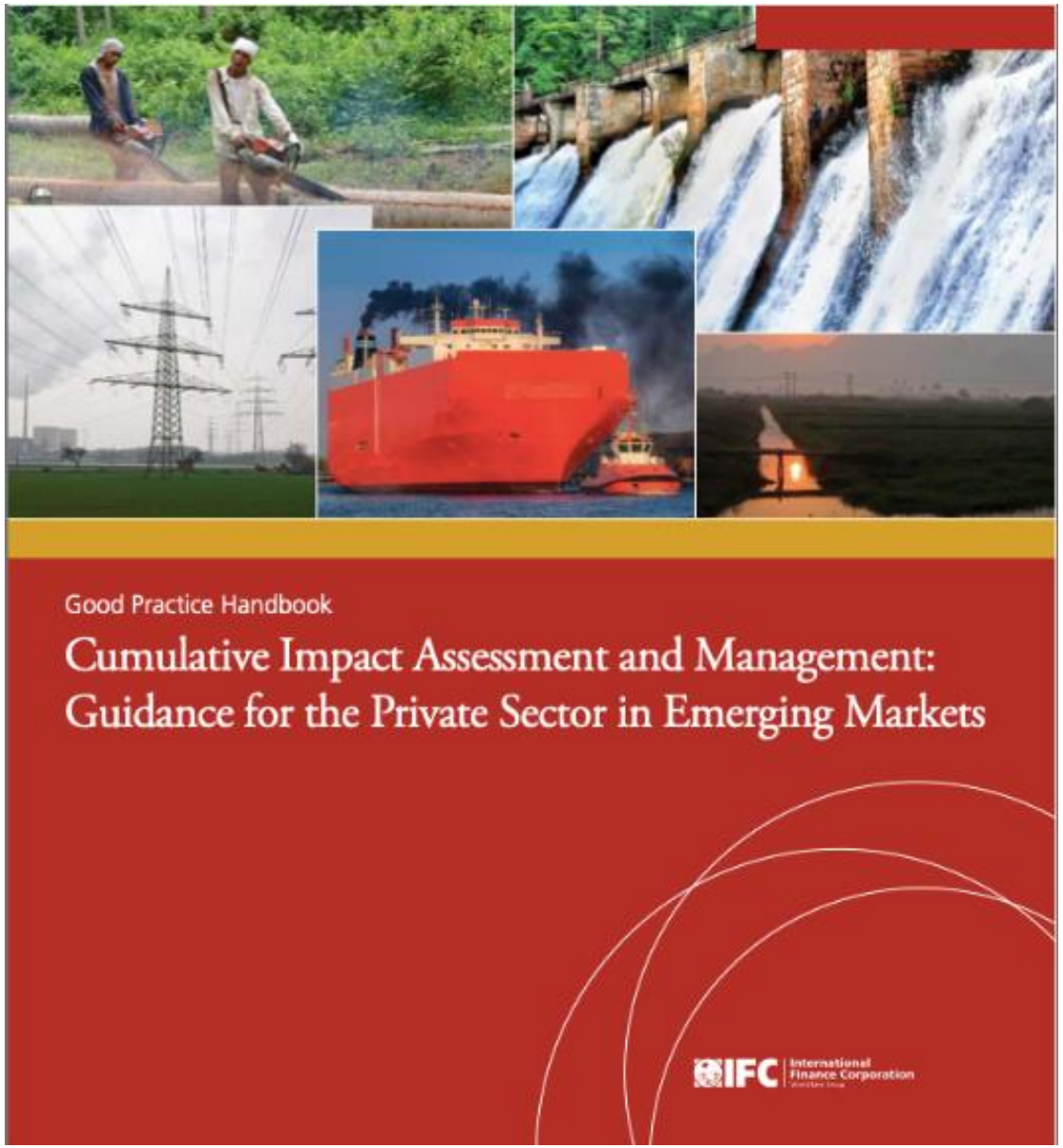
Valued Environmental and Social Components (VECs)

Sensitive environmental or social receptors, affected resource, ecosystem, or human community:

- ***Air shed***
- ***Watershed***
- ***Forest resource***
- ***Resident wildlife***
- ***Migratory wildlife***
- ***Fisheries resource***
- ***Historic / Socio-cultural resource***
- ***Land use***
- ***Community Structure***
- ***Coastal zone***
- ***Recreational***

VEC	Cumulative Effect / Change of condition
Air	•Health hazard, poor visibility from elevated levels of ozone or particulates.
Surface Water	•Water quality degradation from multiple point-source discharges. •Water shortages from uses that exceed capacity
Ground Water	•Aquifer depletion
Land and Soil	•Diminished land fertility / productivity
Wetlands	•Diminished flood control capacity
Ecosystems	•Habitat fragmentation •Loss of fish and wildlife populations
Socioeconomics	•Overburden services •Unstable labor markets
Community structure	•Changes in community dynamics as a result of displacement of critical community members.
Cultural Resource	•Cultural site degradation / vandalism •Fragmentation of historic district

IFC Good Practice Handbook on Cumulative Impact Assessment



Available Online at:

https://www.ifc.org/wps/wcm/connect/58fb524c-3f82-462b-918f-0ca1af135334/IFC_GoodPracticeHandbook_CumulativeImpactAssessment.pdf?MOD=AJPERES&CVID=kbnYgI5

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CIAM - Six Step Process

Step 1: Scoping: Geographical and Temporal

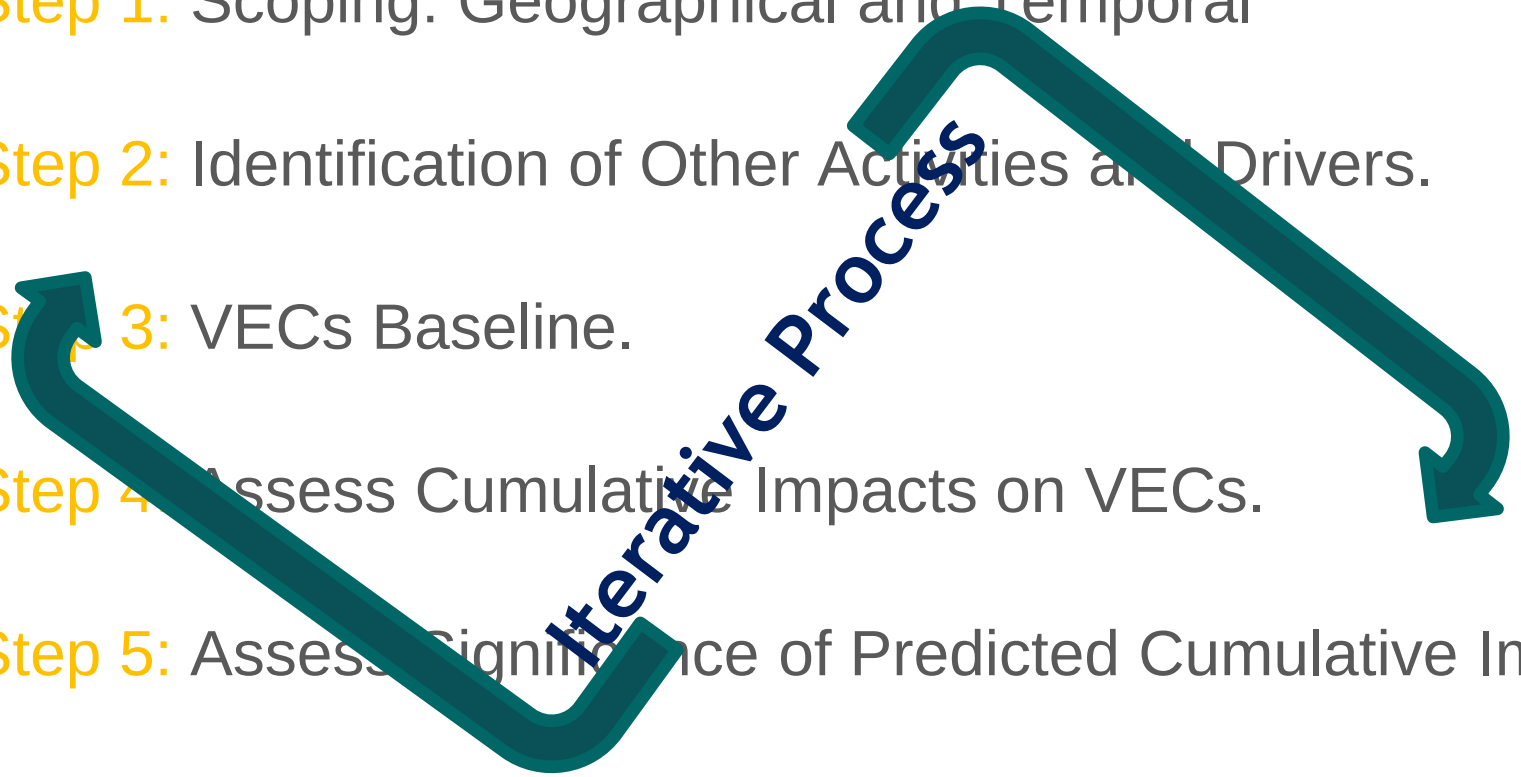
Step 2: Identification of Other Activities and Drivers.

Step 3: VECs Baseline.

Step 4: Assess Cumulative Impacts on VECs.

Step 5: Assess Significance of Predicted Cumulative Impacts.

Step 6: Design Management Strategies.



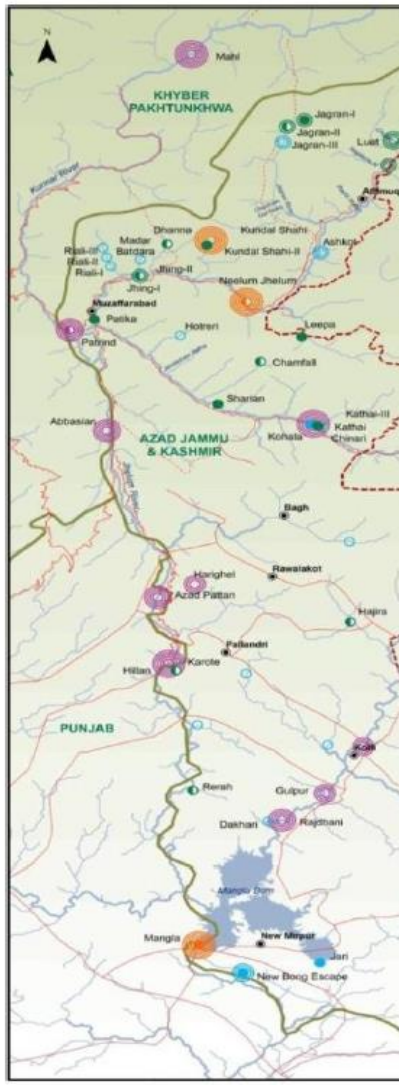
Typical Approach for Cumulative Impact Assessment

- Impact of the project and other activities on VECs at landscape (e.g. watershed, airshed, flyway) level, and then
- Impact of planned and foreseeable projects/ activities on the VECs

Value of performing a Cumulative Impact Assessment

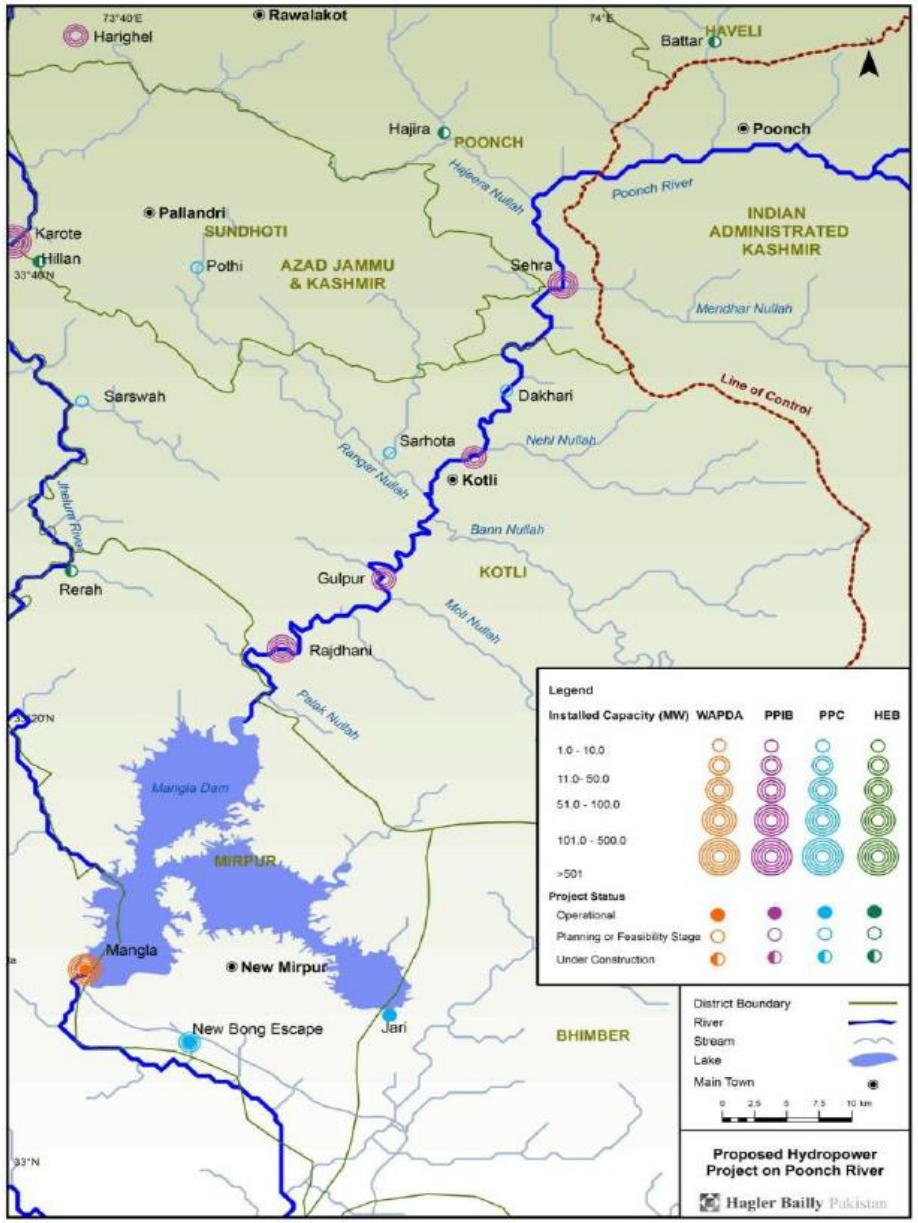
- Compiles a baseline of environmental and social information for the basin / landscape
- Draws attention to cumulative impacts
- Documents the extent and magnitude of cumulative impacts
- Documents locations of cumulative impacts
- Documents the types of cumulative impacts and receptors
- Documents stakeholder views of the cumulative impacts
- Makes recommendations for mitigation and management to reduce the cumulative impacts

Exhibit 2.2: Locations, Capaciti
of Hydrop



Source: IUCN (March 2014), Strategic Enviro
Jammu and Kashmir, Final Report.

Exhibit 2.4: Proposed Hydropower Projects on Poonch River



- **Total of 62 HPPs in the AJK**
- **Four in the Poonch River**

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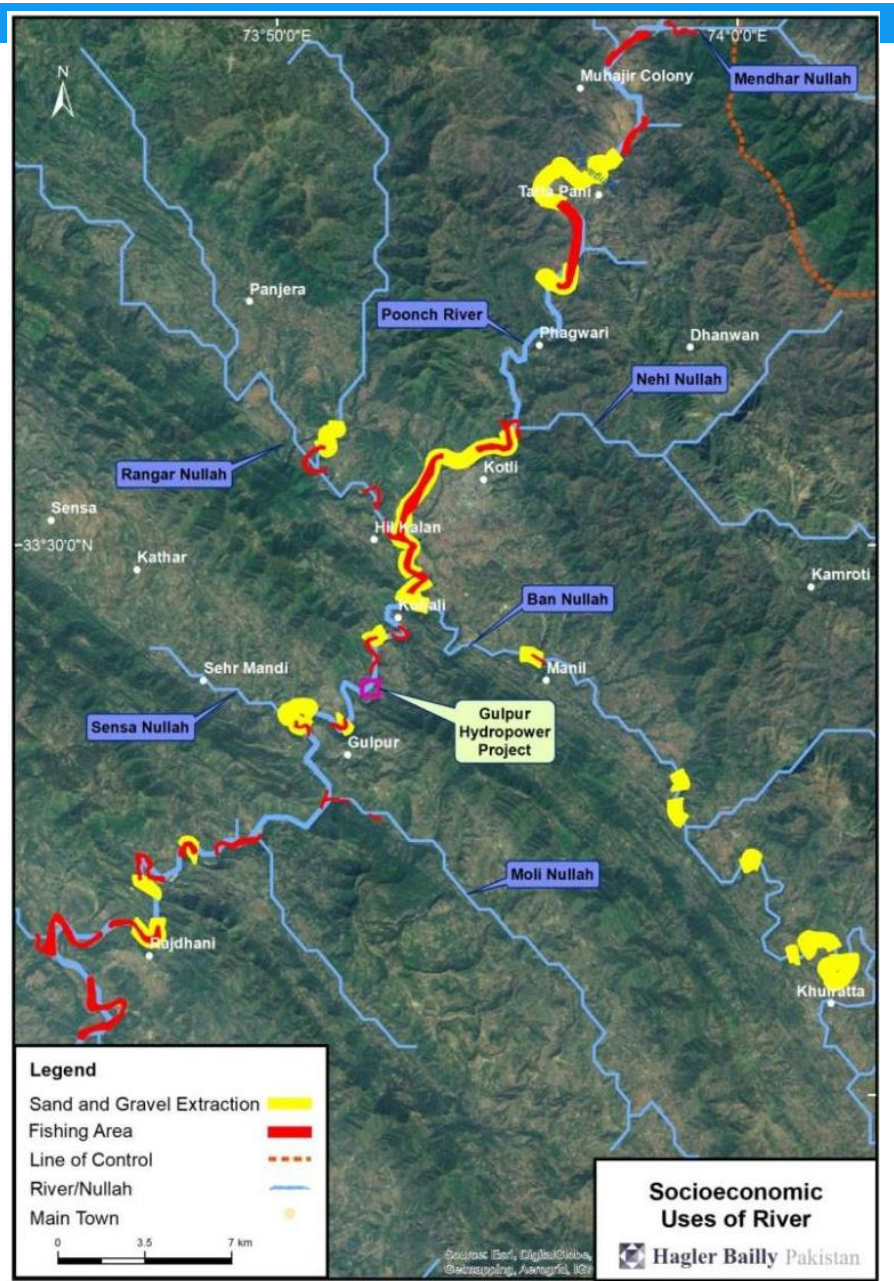
Mapped the Socioeconomic uses of water and pressures over the aquatic and riparian ecosystem

- Selective Fishing Pressure
- Non-selective Fishing Pressure
- Mining – Sand and Gravel
- Mining – Cobble and Boulder
- Water Quality



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The VECs

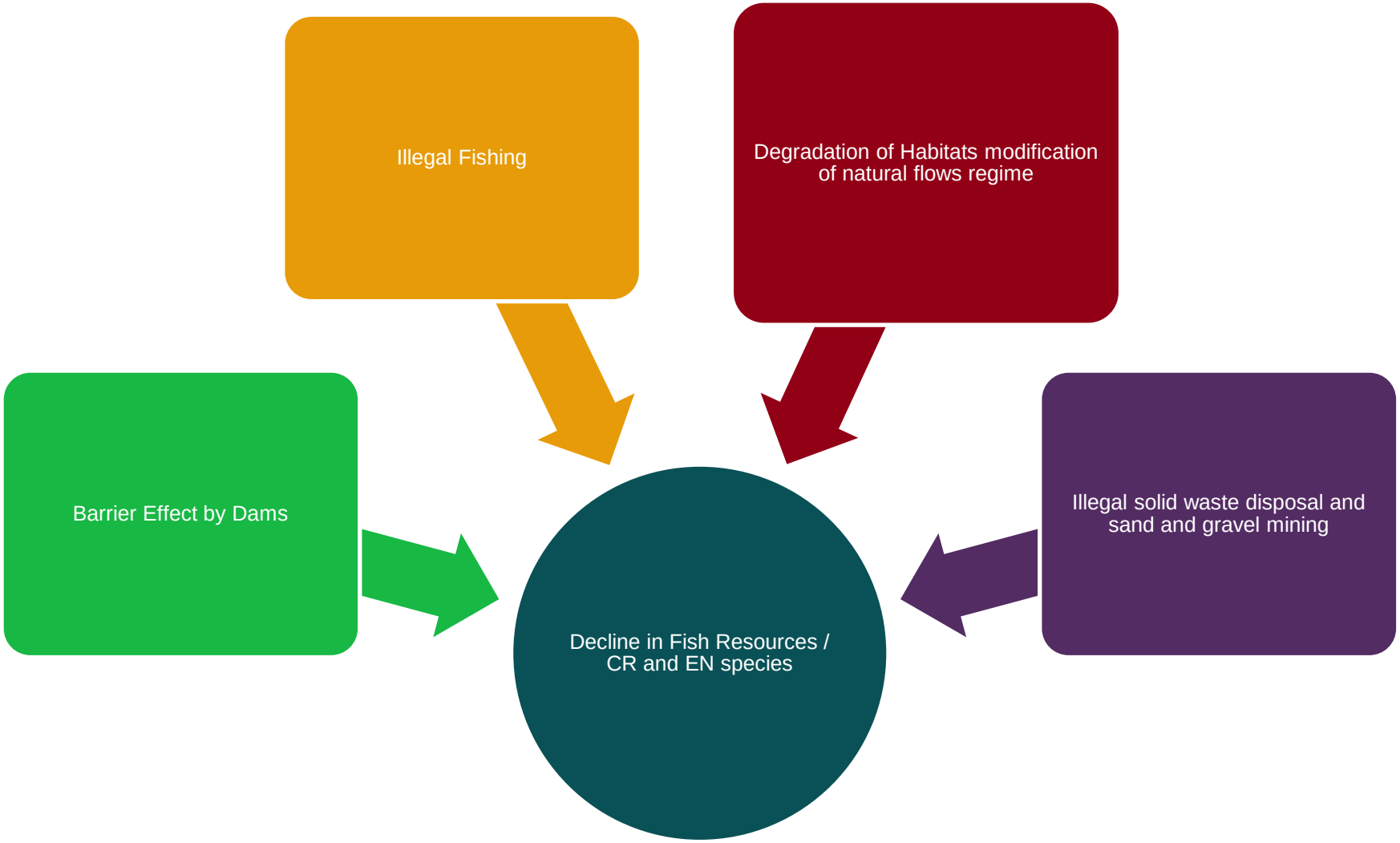
- Fish Fauna
- Sediment Load of the River
- Surface Water Quantity – Flow
- Landscape

Consultation with NGOs and Scientists

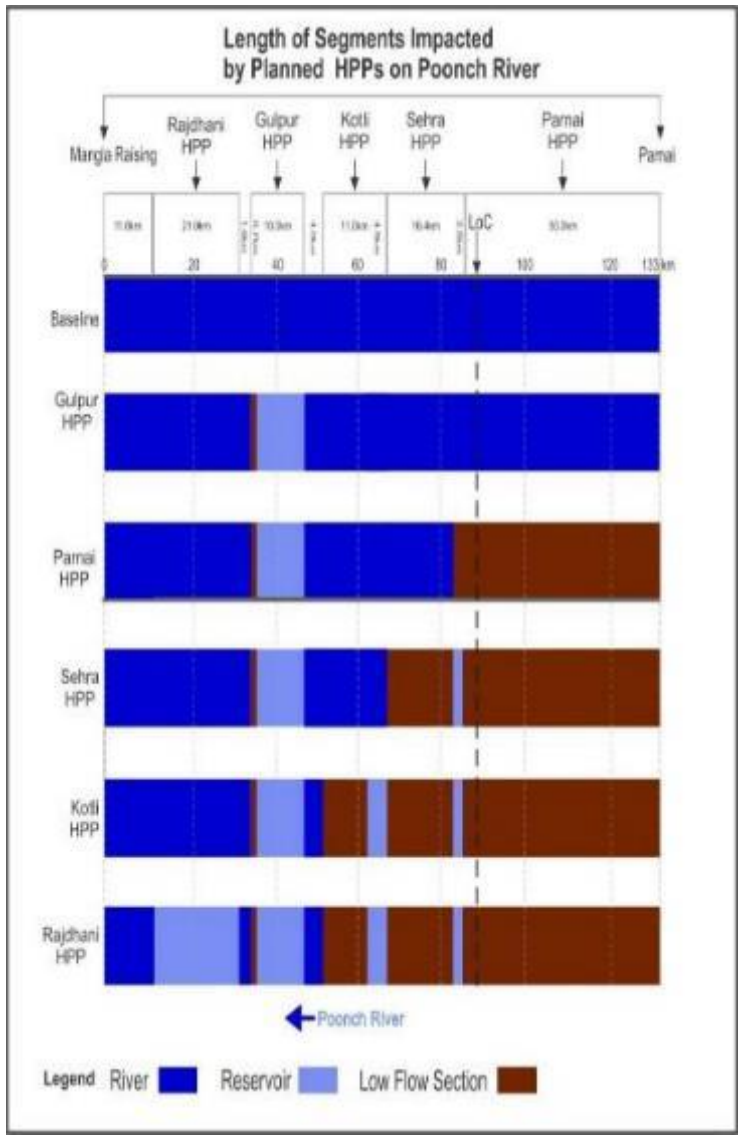
Community Consultation with Men

Community Consultation with Women

Cumulative Impacts on Fish in the Poonch River



Cumulative Impacts



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Cumulative Impact on Ecological Integrity

River Reach		2013	Sequential implementation of:				
			Gulpur HPP	Parnai HPP	Sehra HPP	Kotli HPP	Rajdhani HPP
Poonch River upstream of LoC	Parnai weir to LoC	B	B	C/D	C/D	C/D	C/D
Poonch River downstream of LoC	LoC - 5 km	B/C	B/C	C/D	D	D	D
	10	B/C	B/C	C	No river remaining	No river remaining	No river remaining
	15	B/C	B/C	C	D	D	D
	20	B/C	B/C	C	D	D	D
	25	B/C	B/C	C	D	D	D
	30	B/C	B/C	C	C	No river remaining	No river remaining
	35	B/C	B/C	C	C	D	D
	40	B/C	B/C	C	C	D	D
	45	B/C	No river remaining	No river remaining	No river remaining	No river remaining	No river remaining
	50	B/C	No river remaining	No river remaining	No river remaining	No river remaining	No river remaining
	55	B/C	D	D	D	D	No river remaining
	60	B/C	B/C	B/C	C	C/D	No river remaining
	65	B/C	B/C	B/C	C	C/D	No river remaining
	70	B/C	B/C	B/C	C	C/D	No river remaining
	75	B/C	B/C	B/C	C	C/D	D
	80	B/C	B/C	B/C	C	C/D	D
	85	B/C	B/C	B/C	C	C/D	D
	90	B/C	B/C	B/C	C	C/D	D
Mendhar Nullah		B	B	D	D	D	D

B = blue, B/C and C = green, C/D = white, D = orange, No river remaining = red

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Proposed Approach

- Given the state of protection in the Poonch River, there will not be much of environmental resource left to protect if the present trends continue.
- Implement a Biodiversity Action Plan (BAP) to address basin level protection of wildlife which is in jurisdiction of AJK Fisheries and Wildlife Department.
- Implementation of the BAP requires commitment from the government. Additional resources for the BAP will be provided by the Project.
- The government and Project owner signed an agreement to implement the BAP

CIAM in Action!

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POWER OPTIMIZATION & INTEGRATING WITH CIAs

SEKONG RIVER BASIN, LAO PDR

Dzenan Malovic, Energy Specialist, IFC
Kate Lazarus, Senior ESG AS Lead, IFC
21 April 2021

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POWER SECTOR DEVELOPMENTS – OPPORTUNITIES AND CHALLENGES

- **Rapid power sector expansion in Lao PDR**:
  - 700 MW in 2006 to >6,000 MW in 2016
  - Ongoing expansion -- 30+ hydropower projects under development in the Sekong basin, with the total capacity >2,500 MW
  - Dam safety issues
- Significant **economic contribution** in terms of direct government revenue, FDI, GDP growth, but **challenges to secure the market** for all participants
- Expansion to other **renewables (solar and wind)** expected
- Mainstreaming / reaching international standards of **social and environmental issues** essential:
  - E.g. aquatic & terrestrial biodiversity, livelihoods, land acquisition & resettlement, conflict
- Taking **'risk management approach'**
- Multiple projects in the same watershed have **cumulative impacts** that need to be better understood.

CUMULATIVE IMPACT ASSESSMENT (CIA)

- CIA is an **internationally recognized approach** to identify, assess, manage and mitigate risk during the planning process
- **Cumulative impacts** are greater than the sum of individual project effects
- CIA is required as part of **project-level ESIAs** (Lao MoNRE, 2013) but conducting them at basin scale helps all activities in the same watershed
- **Draft Guidelines for Hydropower CIA in Lao PDR** developed in 2017 and have been revised after the Sekong pilot CIA

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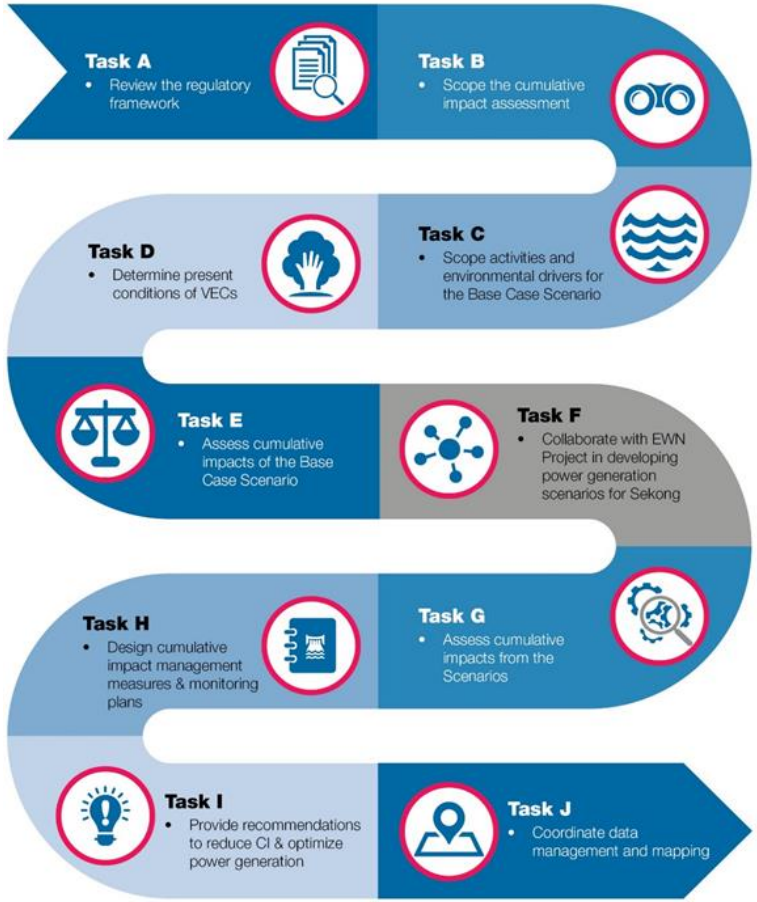
CIA PROCESS AND CHALLENGES



- A comprehensive CIA for hydropower requires **consideration of all developments** in the basin
- **Timing** is crucial
- Individual project developers **lack data and information on the basin**, including upstream and downstream projects
- **Requires cooperation** between power developers, environmental & social practitioners, government and other stakeholders

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WHY INTEGRATING CIA WITH POWER OPTIMIZATION

- Traditionally, CIAs and power planning/optimization used to be developed independently
- Cumulative impacts within a geographical region/watershed can impact the design and the output of RE projects
- Additionally, CIAs are often developed at the later point in project development, hence the changes stemming from CIAs are sometimes hard to implement and costly
- In case of hydros, this is particularly important since impacts identified by CIAs can affect the multiuse of water resources, sediment transport, or change other environmental and social dynamics around the project
- Therefore, early integration of both approaches is crucial

POINTS TO CONSIDER

Full integration of power sector analysis into the CIA scenarios

The analysis still VECs-centered, but includes assessment of impacts on:

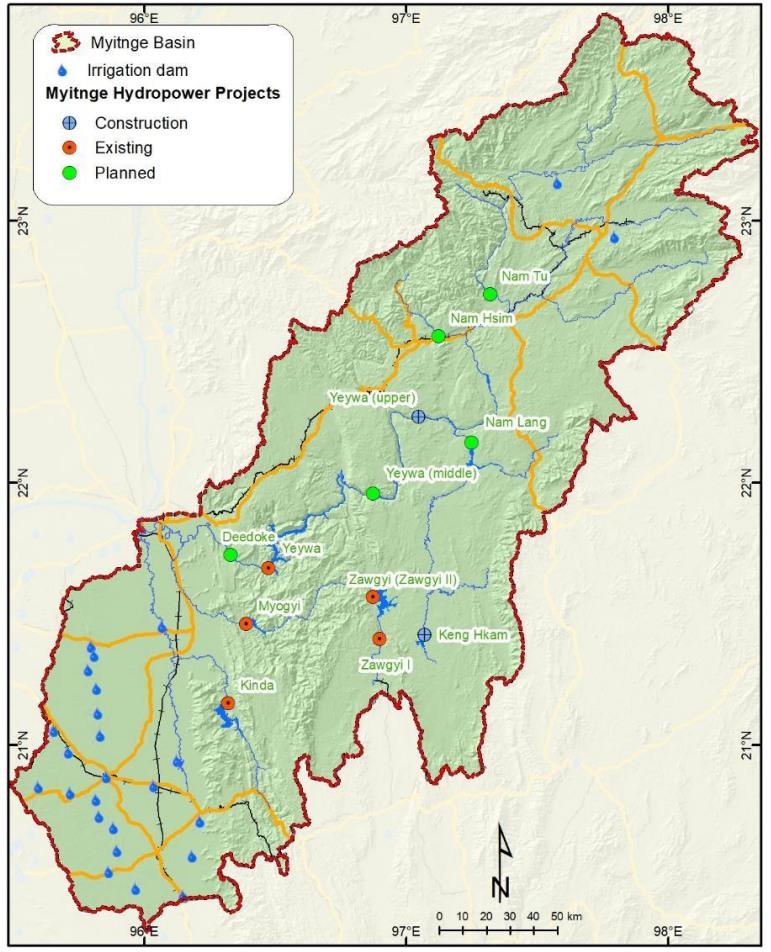
- Individual project and/or cascade of projects (e.g., project design, operational rules, sequencing of commissioning, etc.);
- Power sector of the geographical boundary or a wider region in general (e.g., demand / supply balances, transmission / distribution network planning, etc.);
- International obligations of a country (e.g., export PPAs); etc.

In some cases, power sector indicators used as VECs (e.g., (firm) generation, installed capacity, investment costs, LCOEs, etc.)

The final output of the analysis is a well-balanced trade-off across technical, financial, economic, and social and environmental objectives

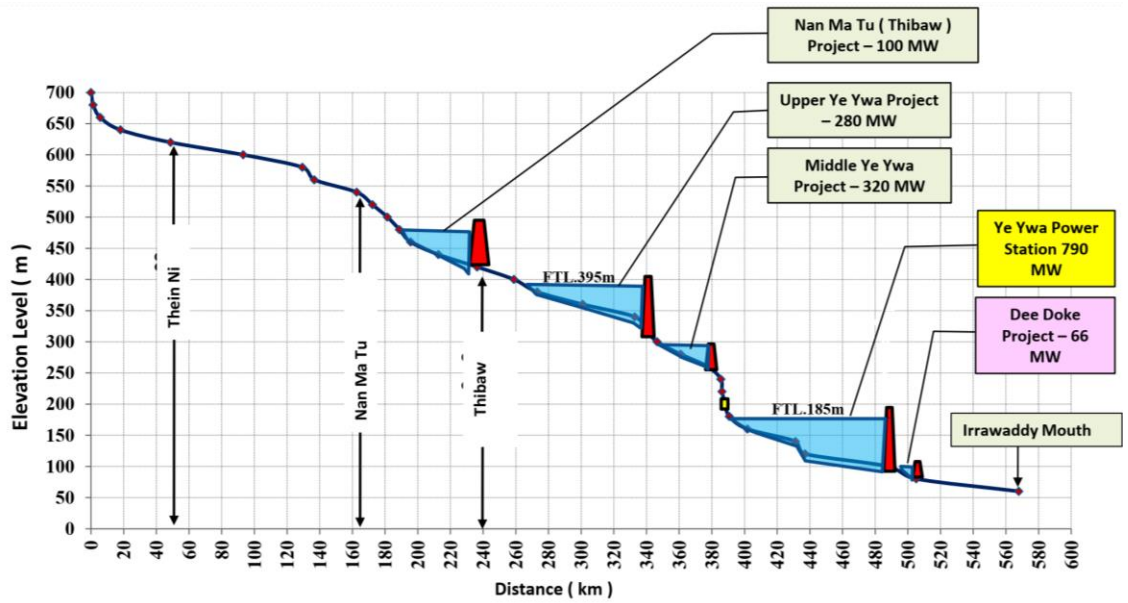
THE HYDRO APPROACH:
KEY CRITERIA, MINIMIZING CUMULATIVE IMPACTS

- Overview of existing and planned HPPs with respect to size, locations, design, implementation, storage capacity, operational regime, and power production
- Review designs to assess the modifying potential with respect to mitigation of impacts (e.g., improving spillways, fish ladders, sediment flushing, etc.)
- Undertake a high-level analysis of CAPEX, ensuring appropriate conversions to enable comparability
- Establish metrics of technical, financial and economic criteria (e.g., rated/firm power and generation, total/live storage, investments, unit costs, LCOE, IRR, NPV, etc.)
- Clarify the transmission infrastructure, considering transmission lines, associated infrastructure, ancillary elements, and interconnections
- Analysis of non-power interests (upstream water uses; downstream ecological impacts of flow regulating reservoirs; forestry; mining; tourism; industry; community development)



THE HYDRO APPROACH:
INTEGRATED RIVER BASIN DEVELOPMENT

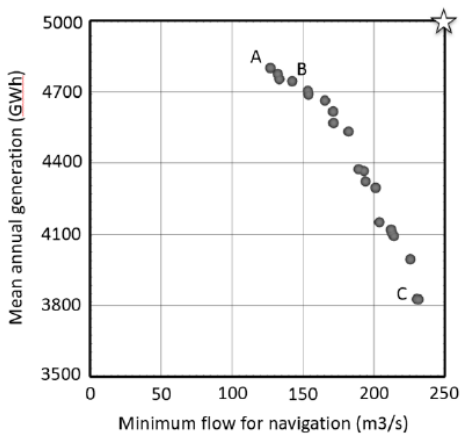
- Identify integrated river basin development scenarios, taking into consideration all water uses in the basin. If done this way, water and power planning will be fully integrated
- To be mindful that multi-purpose uses of reservoirs for water supply, river regulation, flood mitigation, irrigation, and generation are competing (e.g., the use for flood mitigation would diminish power production)
- To consider impacts of cascading effects assuming coordinated operation of all HPPs in the system (e.g., optimized energy yield for the whole cascade, flood flows to be evacuated, Eflows to be released, sediment transport, etc.)



THE HYDRO APPROACH: TRADE-OFF ANALYSIS AND SHORTLISTING SCENARIOS

- Scenarios combining water use and power production will be analyzed and checked across technical, financial, economic, social and environmental objectives, using multi-criteria decision tools
- Trade-offs between key criteria to be undertaken
- Building on the trade-off analysis, produce a short-list of scenarios that fulfil the established success criteria
- Two or three scenarios to be selected for the final analysis,
- The selected scenarios represent different approaches in basin development (e.g., maximizing small-scale and alternative RE options, maximizing multi-purpose HPP potential, minimizing transboundary impacts)
- Select a recommended scenario

Evaluation Score (ES)	Range Value (RV)	Description of Range Band
72 to 108	5	Major positive change/impact
36 to 71	4	Significant positive change/impact
19 to 35	3	Moderate positive change/impact
10 to 18	2	Positive change/impact
1 to 9	1	Slight positive change/impact
0	0	No change/status quo/not applicable
-1 to -9	-1	Slight negative change/impact
-10 to -18	-2	Negative change/impact
-19 to -35	-3	Moderate negative change/impact
-36 to -71	-4	Significant negative change/impact
-72 to -108	-5	Major negative change/impact



☆ Ideal solution (unobtainable)

New projects built	A	B	C
Deedoke	x	x	
Middle Yeywa (low)	x		
Middle Yeywa (high)		x	
Hsipaw	x	x	

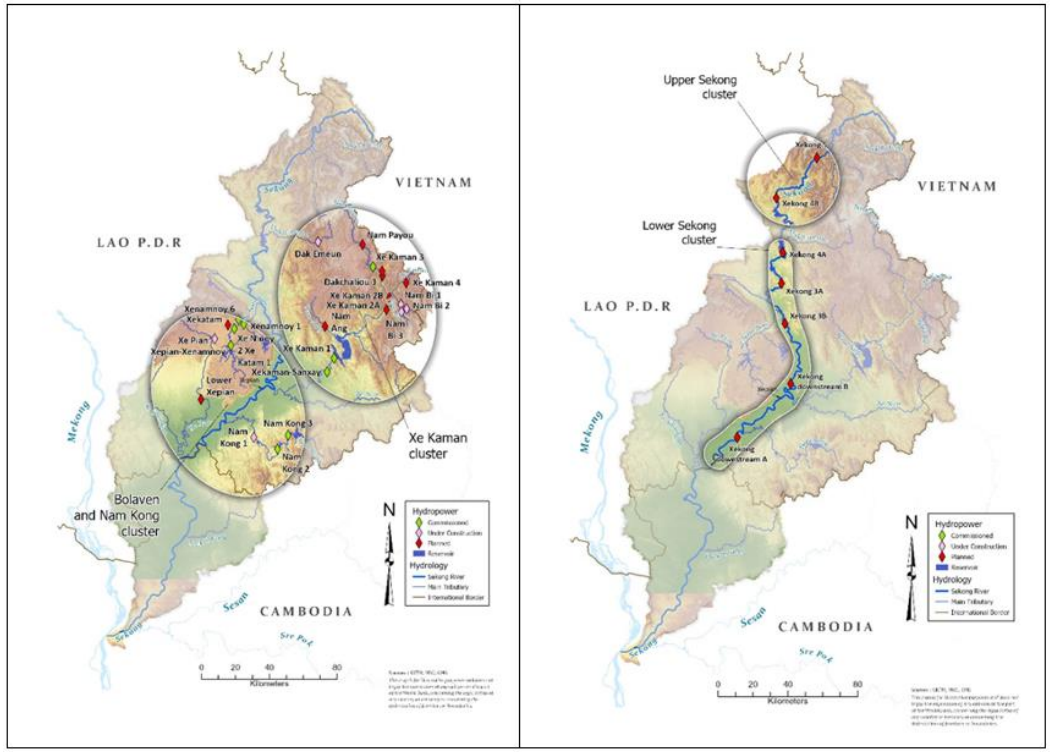
SEKONG CIA

- Three development pathways defined, reflecting progressive levels of basin development:
  - ➢ The full development pathway, representing the expected situation in 2030 if all proposed projects are implemented.
  - ➢ The conservative development pathway, defined with a focus on maintaining the Sekong mainstream free flowing
  - ➢ The intermediate development pathway, involving the same HPPs as the full development pathway, with the exception of the two uppermost HPPs on the Sekong mainstream
- All three pathways assume 600 MW of solar and wind each, providing ~3 TWh of energy

Development pathway	Renewable energy projects
Present situation	12 HPP projects already built or under construction and due to be operational in 2020
Full	35 HPP projects proposed to be built and commissioned in 2030 Wind and solar projects with 3 TWh of annual generation
Conservative	28 HPP projects (as in full development pathway but omitting all 7 mainstream dams) Wind and solar projects with 3 TWh of annual generation
Intermediate	30 HPP projects (as in full development pathway but omitting 5 of 7 mainstream dams) Wind and solar projects with 3 TWh of annual generation

SEKONG CIA – PROJECT CLUSTERING

- Due to their large number, the projects have been grouped into spatially defined clusters
- The aim is to facilitate systematic, manageable analysis of the cumulative E&S effects, and to explore the benefits of joint operation and management of water resources
- Clusters selected to provide significant export capacity with minimal economic, environmental, and social costs
- A minimum size of 300 MW per cluster has been set as a limit
- Five clusters defined



SEKONG CIA: IMPACT ON VECS – FULL DEVELOPMENT PATHWAY

Fish and Aquatic Ecosystem

Full Development Pathway: Aquatic Ecosystem and Fish Stocks
Impact Score: Largely Modified

Full Development Pathway: Aquatic Habitat Fragmentation and Connectivity
Impact Score: Largely Modified

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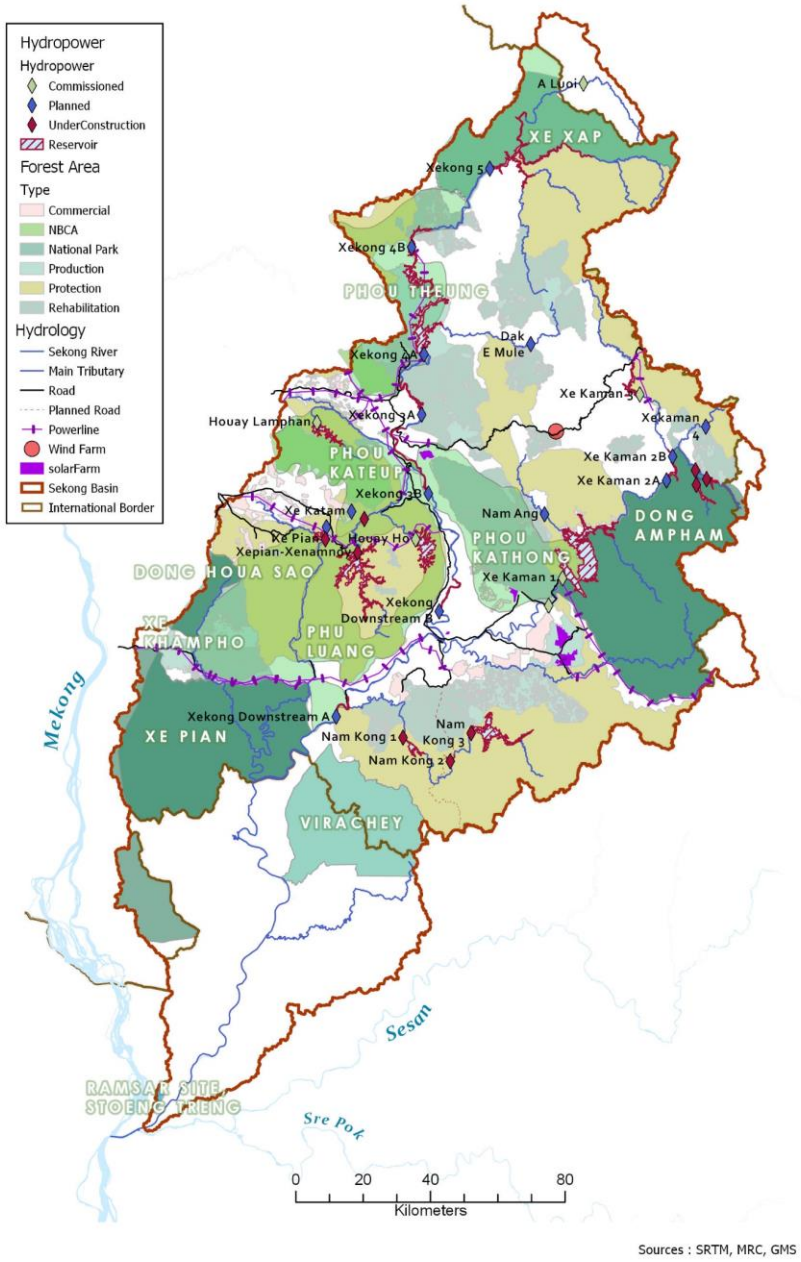
Sekong CIA: Impact on VECs – Full Development Pathway

Impact on Terrestrial VECs (Key Conservation Areas, Habitats and Terrestrial Species)

Full Development Pathway: Key Conservation Areas, Habitats and Terrestrial Species
Impact Score: Moderately Modified

Other stressors like mining, plantations, transmission line and roads development, hunting and forest resource extraction will be equally or more predominant to impact this VEC

Phonesack Lignite Mine at Kaleum District



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Sekong CIA: Impact on VECs – Conservative Development (Environmental Conservation) Pathway

28 Dams
None on mainstream

Installed Capacity – 2470 MW

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Impact on VECs – Conservative Development Pathway

Fish and Aquatic Ecosystems

Conservative Development Pathway: Aquatic Ecosystem and Fish Stock
Impact Score: Slightly Modified

Conservative Development Pathway: Aquatic Habitat Fragmentation and Connectivity
Impact Score: Slightly Modified

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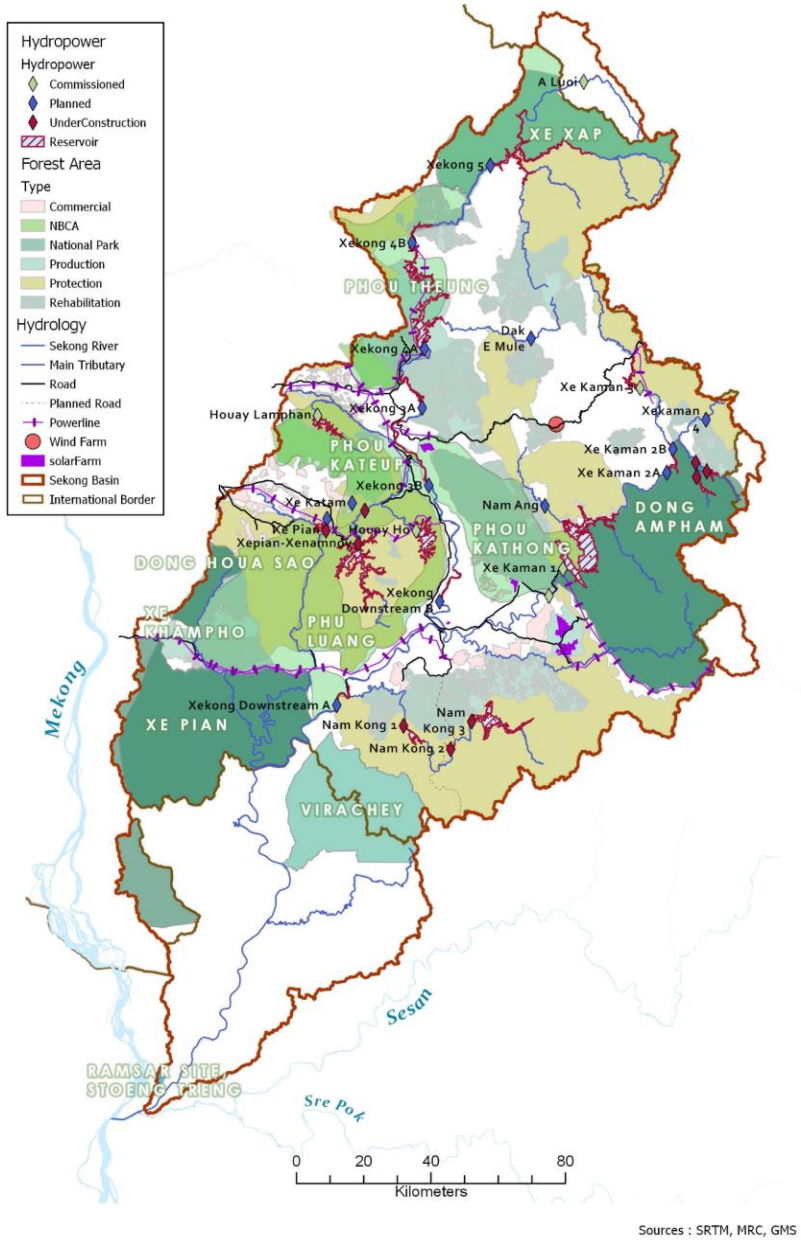
Impact on VECs – Conservative Development Pathway

Impact on Terrestrial VECs (Key Conservation Areas, Habitats and Terrestrial Species) – Slightly less than Full Development Pathway

Conservative Development Pathway: Key Conservation Areas Habitats and Terrestrial Species

Impact Score: Slightly to Moderately Modified

Other stressors like mining, plantations, transmission line and roads development, hunting and forest resource extraction will be equally or more predominant to impact this VEC



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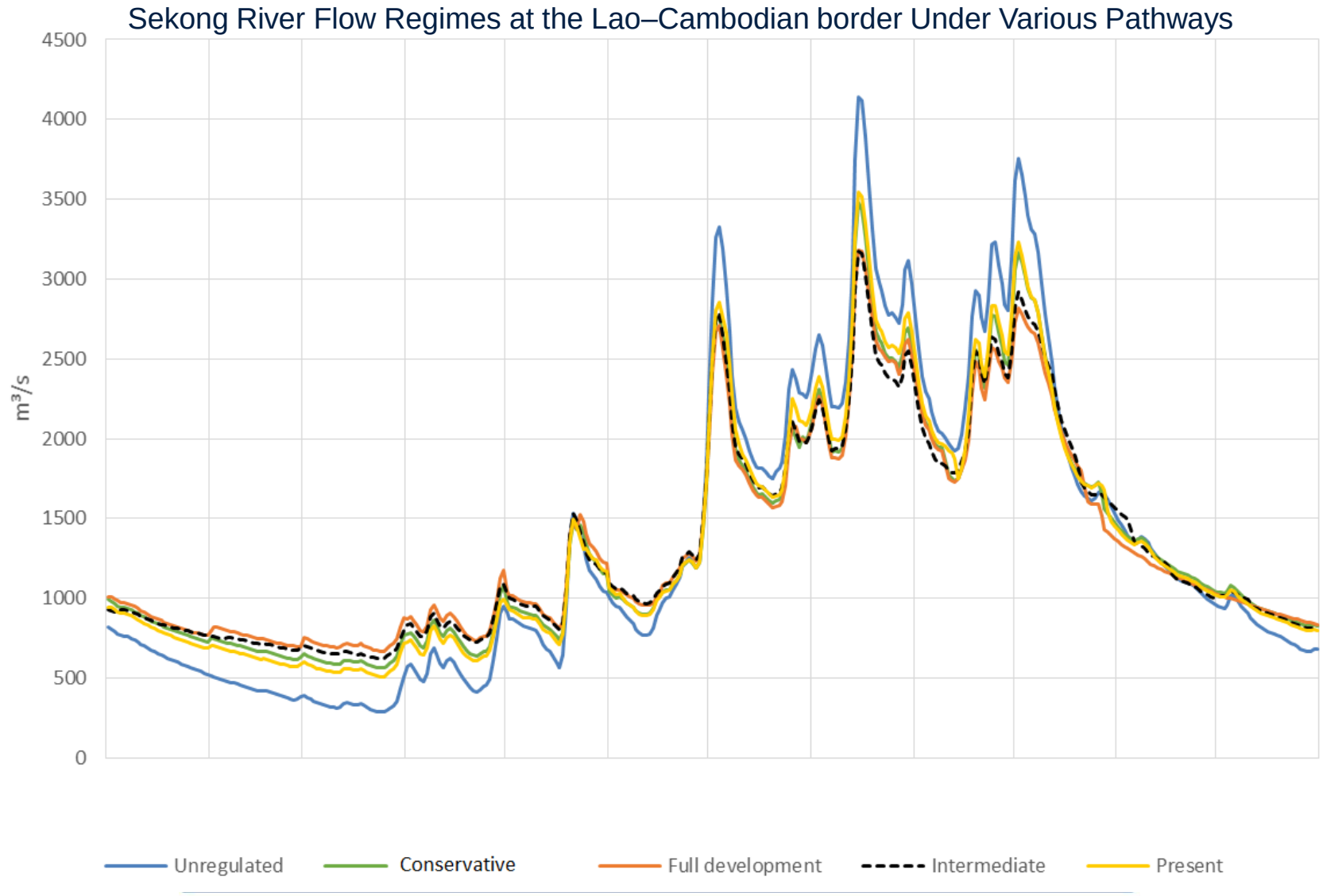
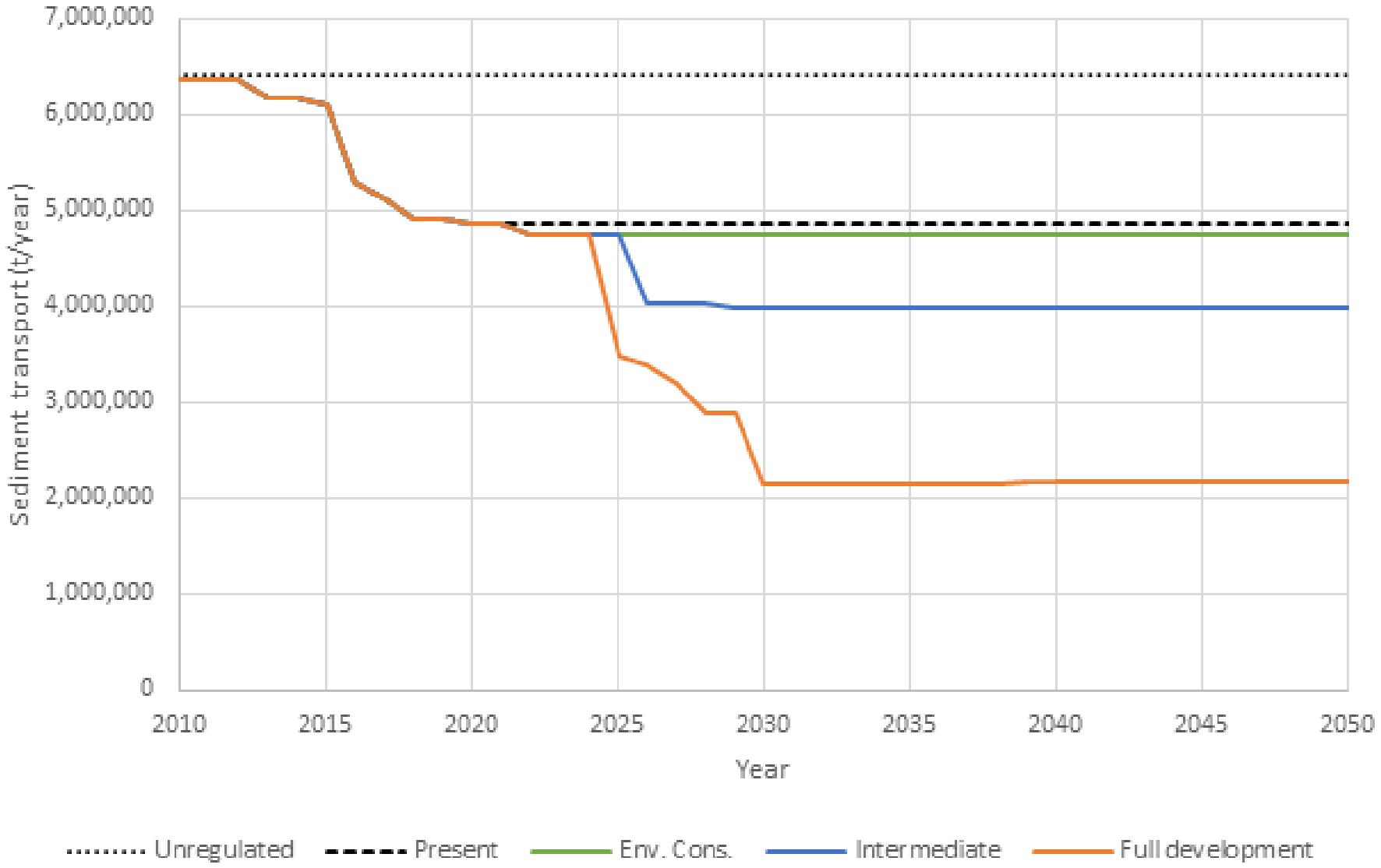
Summary of Cumulative Impacts on VECs

VEC Impact/Pathways	Full Development	Intermediate Development	Conservative Development
AQUATIC VECs			
Flow Change Impacts on Aquatic Fauna	Largely	Slightly to Moderately	Slightly
Fish Connectivity	Largely	Moderately	Slightly
TERRESTRIAL VECs			
Key Conservation Areas Habitats and Terrestrial Species	Moderately	Slightly to moderately	Slightly to moderately
SOCIAL VECSs			
Sekong and Tributary Fisheries	Severely	Moderately to largely	Moderately
Agriculture	Largely	Slightly to moderately	Slightly
Timber	Moderately	Slightly to moderately	Slightly
Non-timber Forest Products (NTFP)	Moderately	Slightly to moderately	Slightly
Resettlement and Displaced People	Largely	Moderately	Slightly
Ethnic Customs and Language, Religious Beliefs	Moderately	Slightly	Slightly
Gender	Moderately	Slightly	Slightly

SEKONG CIA – HYDROLOGICAL AND WATER BALANCE MODELLING



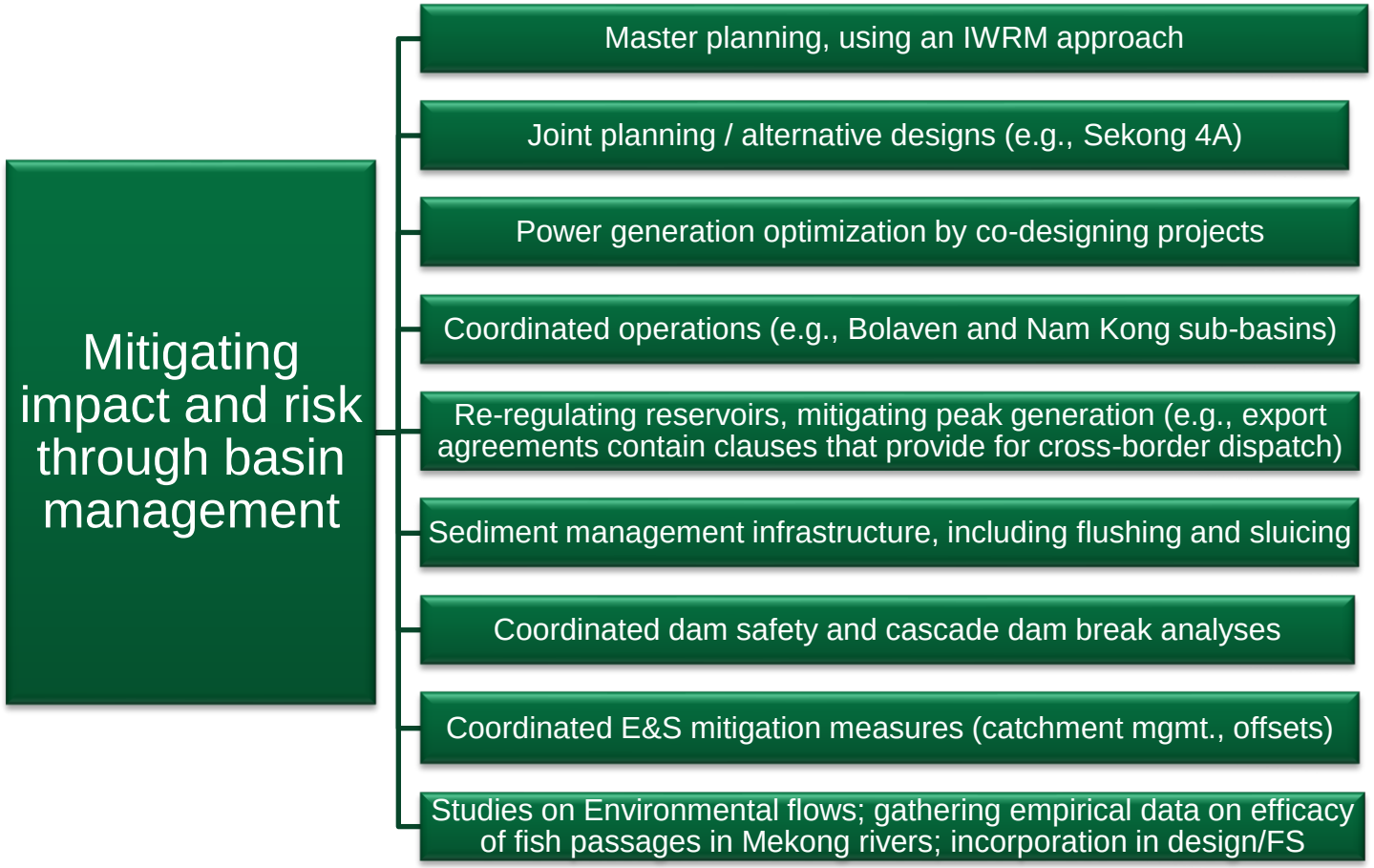
SEKONG CIA – SEDIMENT TRANSPORT MODELLING



SEKONG CIA – HYDROPOWER MODELING AND POWER OPTIMIZATION ASSESSMENT

Project	Model Results			Figures reported in project feasibility studies
	Maximize generation	Maximize firm power	Seasonal storage	
	GWh/year			
Sekong No.1	1,239	1,200	1,159	1,500
Sekong No.2	736	756	757	750
Sekong No.3	734	749	752	780
Sekong No.4	368	370	371	460
Sekong No.5	307	310	310	400
Sekong No.6	176	180	181	210
Sekong No.7	423	438	439	380
Total	**3,983**	**4,003**	**3,970**	**4,480**

SEKONG CIA – MITIGATION STRATEGIES



QUESTIONS?