ISH0306 - Consultancy for the Development of Guidelines for Hydropower Environmental Impact Mitigation and Risk Management in the Lower Mekong Mainstream and Tributaries

The Role of Guidelines for Sustainable Hydropower Practise

Vientiane, Lao PDR, August 10-11, 2017
Introduction - Process 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 offset residual impacts identified at different stages
Introduction - Process for Risk and Impact Mitigation Assessment

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

Master Plan

Feasibility Study

Project Design

Sea, CIA, EIA
Avoid Impacts

Understand the characteristics of the impact

Research mitigation options

Design and Operation measures, rules and procedures, offsets, conditions

Avoidance

Minimization

Compensation

Project Construction and Operation
Overall Structure of the Guidelines, Manual and Knowledge Base

1. The Guidelines (Volume 1)
   • Key Lower Mekong Hydropower Risks, Impacts and Vulnerabilities
   • Guiding principles for mitigation
   • Detailed Mitigation Options for the Different Project Phases

2. The Manual (Volume 2) to support implementation of Guidelines
   • How to choose the most tailored and right mitigation options proposed in the Guidelines.
   • Describes in detail hydropower environmental risks and impacts for each theme and the effect of
   • Examples and experiences of good industrial practice

3. The Knowledge Base (Volume 3)
   • Searchable library on relevant literature
   • Connected to the guidelines and manual literature
Overall Structure of the Guidelines

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

General Principles
- Sustainability
- Holistic approach
- Consideration of hydropower types
- Weighing public interest
- Public participation
- Adaption to Climate Change

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

Guidelines and Recommendations for operation of existing and new hydropower

General and Detailed Mitigation Options (including impacts, risks and vulnerabilities)
- Theme
- Project life cycle
Overall Structure of the Guidelines and Manual

Focus Themes:
1. Hydrology and downstream flows
2. Geomorphology and sediments
3. Water quality
4. Aquatic ecology and fisheries; and
5. Biodiversity, natural resources and ecosystem services
6. Engineering design and operation response to the above

Related to defined
Guidelines Structure – Detailed Mitigation Measures

Structure based on five broad environmental risk areas:

- (I) Annual / Inter annual changes to flow
- (II) Short term flow fluctuations
- (III) Loss of river connectivity
- (IV) Impoundments
- (V) Diversions / intra basin transfers

Responses are provided in a matrix:

<table>
<thead>
<tr>
<th>Risk / impacts</th>
<th>Planning / design /construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Options</td>
<td>Indicators</td>
</tr>
<tr>
<td>(1) Avoidance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Mitigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Compensation</td>
<td></td>
<td></td>
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<tr>
<td>(4) Adaption</td>
<td></td>
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</tr>
</tbody>
</table>

Each risk is given a reference number in the matrix eg (IV.2). Mitigations for that risk can then be found in the manual eg (IV.2.1, IV.2.2, etc).
Structure and usage of Knowledge Base

1) Knowledge Base Report
2) Document inventory sheet
3) Knowledge Base Library
### Structure and usage of Knowledge Base

**Data Inventory Sheet**

- Complete overview of all articles/reports/publications that have been collected throughout the project period
- Easy to navigate: Excel file to allow sorting/filtering and search function
- Contains more than 1000 organized references also reflected in the library

<table>
<thead>
<tr>
<th>First author</th>
<th>Year</th>
<th>Title</th>
<th>Journal</th>
<th>Other Information</th>
<th>Geographic Focus</th>
<th>Search word</th>
<th>Full Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arias, M.E.</td>
<td>2014</td>
<td>Impacts of hydropower and climate change on drivers of ecological productivity of Southeast Asia’s most important wetland</td>
<td>Ecological Modelling</td>
<td></td>
<td>Tonle Sap</td>
<td></td>
<td>Arias, M.E. et al. 2014. Impacts of hydropower and climate change on drivers of ecological productivity of Southeast Asia’s most important wetland. Ecological Modelling 272: 152-263.</td>
</tr>
</tbody>
</table>
Used to suggest updates of the 2009 PDG and 2001 HDS

- **PDG review/update**: Assess necessary updates of the 2009 version of the PDG, including planning principles taking into account mitigation throughout the whole hydropower life cycle, additional themes for consideration, updates of existing themes, inclusion of specific engineering design principles, inclusion of tributary dams development, planning and design as well as needed updates on dam safety.

- **HDS review/update**: Assess necessary updates of the 2001 version of the Hydropower Development Strategy taking into account; recent hydropower developments in the LMB, sustainable hydropower development principles, recent plans and strategies on the LMB as well as Guidelines and results from ISH0306.
Review and Update of the PDG

Additional Themes for Consideration

Principles for Engineering Design and Operation

The key design objectives that might be considered in the revised PGD include:

1. Adoption of lower dams so that effective fish upstream migration can take place.
2. Adoption of finer and larger power intake screens to improve fish exclusion and survival rates for downstream migration.
3. Smaller reservoirs to reduce residence time, water quality problems and sediment trap efficiency.
4. Introduce energy recovery on fish passage systems to reduce losses to commercially acceptable levels.
5. Avoid gated weir type spillways and adopt full height gated barrages so that the river can be retained in a natural condition during project construction and returned to natural conditions for sediment transport and fish migration.
Review and Update of the PDG

Existing Themes Update

**Sediment Transport and River Morphology**

Multiple comments on and corrections to existing clauses in PDG 2009, including lack of emphasis on considering the development in the ‘bigger’ catchment context. Main recommendations from ISH0306 as follows:

- Dam siting in master plans with regard to avoid sediment transport and river morphology hotspot areas (for example studied by Schmitt et al. 2017 in the 3S system).
- Design multiple large gated spillways/outlets at multiple levels, and low level sediment outlets.
- Design sediment bypass channels.
- Under operation implement annual sediment sluicing to maintain seasonal pulse.
- Undertake riverbank stabilization works during construction.
- Introduction of annual sediments downstream of impoundments (however practically questionable on mainstream Mekong).
- Minimize sediment runoff through design of access roads and seasonal work schedules.
- Find mechanisms to support or implement catchment management measures to reduce sediment inputs.
- Limit rate of water level drop to prevent slope and dam instability.
Review and Update of the PDG

Existing Themes Update

Fish Passage
Multiple comments on and corrections to existing clauses in PDG 2009, including that of height of functional fish passes. Main recommendations from ISH0306 as follows:

- Dam siting in master plans to avoid risks and impacts in fish migratory hotspot areas. Waiver of planned projects if they are in very sensitive locations and mitigation of negative effects cannot be ensured.
- Consideration of cumulative effects (not single effects per dam)
- Develop joint operation rules for flow releases, in periods important for migration, including maintaining seasonal patterns, artificial releases and environmental flows.
- Operating rules to minimize flow changes and management of re-regulation weirs to provide appropriate downstream flows
- Consider alternative hydropower designs to minimize impact on connectivity Design measures for fish protection, e.g. suitable rakes, adapted turbines, guidance systems etc.
- Ensure fish passage and connectivity during all phases of the project (incl. construction)
- Avoid high retention time in reservoirs and plan and implement large bypass systems where possible
- Reduce reservoir size to improve flow conditions (e.g. for supporting passive drift of eggs and larvae)
What are the possible usages of ISH0306 results?

For the Member Countries consideration:

• Data and information, Modeling Techniques and Outcomes will be useful for the Council Study

• To use for the Update of the Hydropower Strategy, the Preliminary Design Guidance, etc.

• They can be used to update the works in other sectors (Hydrology and Flows, Sediments and Geomorphology, Water Quality, Fisheries and Aquatic Ecology, Hydropower Operations and Economics, etc.).

• Refine/update the current BDS & SP.

• Prepare tasks/Outputs for the next BDS and MRC SP.

• Etc.
Main Deliveries Final Phase

• Vol 1 - Updated Guidelines Version 3.0 (with Inputs from the Case Study)

• Vol 2 - Updated Manual Version 3.0 (with inputs inputs from the Case Study)

• Vol 3 – Knowledge Base (Structure, Usage, manual and Update on regional and international practise)

• Vol 4 - Case Study Report Version 2.0 (including downstream dams and inputs from Council Study)

• Vol 5 – Discussion Note on Review of Update of PDG (2009) and HDS (2001)

• Vol 6 – Final Closure Report
Thanks for your attention