Prior Consultation on the DSHPP
Public Consultation Briefing

Date: 12 December 2014
Place: Pakse
Country: Lao PDR

Outline

1. Background and purpose of this presentation
2. General information of the Don Sahong Hydropower Project
3. Technical review by the MRC
4. Conclusion
The purpose of this presentation

This presentation summarises the results of the Technical Review process to date more specifically for the regional consultation.

The Technical Review Process supports the MRC PNPCA Joint Committee Working Group (JCWG) by providing an independent expert review of the documents submitted by the developer and the potential impacts of the DSHPP.
The Don Sahong Hydropower Project (DSHPP) – Main Scheme features

1. 260MW (4 x 65MW fish friendly bulb turbines).
2. Excavation of Hou Sahong inlet to divert flows.
3. Excavation and embankment on Hou Sahong to retain a Head Pond
4. Run of River scheme minimal retention in Head Pond
The Don Sahong Hydropower Project (DSHPP) – Main Scheme features

5. At most (in March) 50% of Mekong flow diverted into Hou Sahong – design flow 1600 m³/s.
6. In the ‘wet season’ about 7% of the flow is diverted.
7. Minimum of 800 m³/s over Khone Phapheng Falls (first priority).
8. No peaking operations.

9. ‘Re-engineering’ of Hou Sadam and Hou Xang Pheuk channels for fish migration.
10. No underwater blasting (for dolphin).
11. Implement FishMAP and adjust operations based on results.
THE ROLE OF THE PDG

The Preliminary Design Guidance is preliminary and advisory in nature. The intention is to provide developers of proposed dams on the Lower Mekong mainstream with an overview of the issues that the MRC will be considering during the process of prior consultation under the 1995 Mekong Agreement. Developers need to take the PDGs into consideration when designing mainstream dams.
The Fish Passage and Fisheries Expert Group.

Prof. Ian G. Cowx;
Dr Martin Mallen-Cooper;
Prof Stefan Schmutz
Fisheries Programme; and
National Experts

Key Findings - Fisheries and Fish Passage

Impacts of Dam
- Hou Sahong is blocked by the dam. Loss of:
  - main, year-round route for migratory fish
  - shallow rocky habitats in Hou Sahong
  - livelihoods in Hou Sahong channel
- Downstream migrating fish pass through turbines with variable mortality
- Little impact on hydrology upstream and downstream of Khone Falls
- Major impacts on hydrology of channels within Khone Falls
  - Hou Sahong higher; Khone Phapheng much lower; western channels unknown
Key Findings - Fisheries and Fish Passage

Transboundary impacts

- No transboundary impacts provided by the developer
- Migratory fish from delta, lower Mekong, Tonle Sap, to and from 3S and upstream reaches
- Migration for spawning, feeding, refuge (deep pools)
- Dependent on effective migration past Khone Falls
- If reduction of migration at Khone Falls:
  then proportional loss of migratory fish production regionally
- High value species at risk

Developer proposes:

Upstream Passage
- Improve passage through Hou Xang Pheuak by changing rock profile to improve hydraulics
- Hou Sadam (a small channel) – improve hydraulics and fish passage
- Reduce fishing opportunities and capture through falls
- Capture large fish below dam and transport upstream

Downstream Passage
- Turbines - designed for fish (no supporting evidence)
- Screens on Hou Sahong (recent report)
Key Findings - Fisheries and Fish Passage

Fisheries Expert Group Comments

1. Dam options in other channels not fully explored to minimise impacts
2. Developer should provide all EIA fisheries studies
   - Fisheries, migration, larval drift, livelihoods, socioeconomic
   - All channels; regions upstream and downstream
3. Developer should provide or document all baseline data
   - Especially hydraulics (e.g. depth, water velocity, channel width) of Hou Sahong as this is the basis of other modifications
4. Developer should undertake transboundary assessment

Key Findings - Fisheries and Fish Passage

Fisheries Expert Group Comments

Upstream migration:
Main upstream mitigation of Hou Xang Pheuak has no detailed plan or design criteria
Key Findings - Fisheries and Fish Passage

Hou Xang Pheuak  Hou Sahong

Replicating dry season fish passage capacity is challenging

Fisheries Expert Group Comments

Upstream migration:
Main upstream mitigation of Hou Xang Pheuak has no detailed plan or design criteria

Note: effective fish passage design depends on:
  i. Attraction to the fishway
  ii. Passage through the fishway

• Hou Xang Pheuak is 200 m downstream of DSHP - poor attraction
• The dam location is not optimised to guide fish to HXP
• If project proceeds, a physical model in a hydraulic laboratory is the essential next step (common design practice)
Key Findings - Fisheries and Fish Passage

Fisheries Expert Group Comments

Upstream migration:
- Trap and transport of large fish
  - Need to consider methods
  - High risk of fish damage, internal injury
  - Recommended not to proceed
- Hou Sadam
  - A minor channel with poor attraction
  - Will possibly pass a small proportion of migratory fish
  - Not considered a major mitigation

Upstream migration over Khone Phapheng not fully considered:
Impact of channel modifications of hydraulic needs - full assessment

Khone Phapheng
Pakse 22,423 m$^3$/s - half maximum flow
Possible migration paths
Key Findings - Fisheries and Fish Passage

Fisheries Expert Group Comments

Downstream migration

- Flow bypassing DSHP: 50% (dry) to 93% (wet)
- For small fish and larvae, the risk of passing turbines decreases greatly at higher flows.
- Large, long-lived fish have accurate memories of migration paths upstream and downstream; these fish are more likely to enter Hou Sahong and risk passage downstream through the turbines.
  - Screens are suggested by the developer to divert fish from the turbines and the FEG considers these are essential to minimise mortality of fish, esp. high value species.
  - If project proceeds, screens need testing

Mortality in turbines depends on:

- Blade strike, shear and pressure
- Only blade strike discussed in detail in EIA
- Sudden pressure changes in the turbine causes damage and mortality
  - Damage varies between species; no Mekong fish data
- Fish at higher risk:
  - Dry season spawners or migrants (50% of dry season flow in DSHP)
  - Large, long lived species
Key Findings - Fisheries and Fish Passage

Fisheries Expert Group Comments

Fisheries Monitoring and Action Plan (FISHMAP)

- FISHMAP is 3 pages; developer may have more details
- Essentially only a monitoring programme
  - but no quantitative evaluation or targets;
  - or contingency plans with mitigation actions
- The adaptive management approach requires much more detail
- Should not be used to avoid the most effective options
- Major risk: underfunded
  - Needs a major contingency budget (e.g. 2% of capital cost)

The Dolphin Expert Group.

Dr Isabel Beasley
Environment Programme
The Dolphin Population

- A declining and very threatened population (~85 left in Mekong, and only 6 in the transboundary pool). But still viable.

- Key threats
  - Noise from construction as well as turbines.
  - Altered flow regimes and sedimentation.
  - Increased boat traffic.
  - Reduced prey abundance.

Preliminary prognosis – Dolphin

- No underwater blasting (proposed by developer).
- Future seismic surveys to implement internationally accepted guidelines.
- Sound studies from various construction activities.
- The EMMP should preferably include provisions for monitoring the local dolphin population.
- The monitoring strategy should be developed by independent experts, and peer reviewed.
- The contributions to dolphin conservation efforts should preferably be adequately budgeted and aligned with existing efforts.
The Water Quality and Ecosystems Expert Group.

Dr Peter-John Meynell
Environment Programme

Key findings

• No significant water quality problems are expected during normal operations.
• May be some during construction, but these could be addressed by best practice for construction.
• Focus is on habitat for fish passage; no info on other habitat or ecological impacts in the local area provided.
• Water quality monitoring in the EMMP (including aquatic habitats) and emergency response mechanisms to be put in place.
• The selection of the lowest flow recorded as a basis for the Khone Falls is arbitrary
• There are options to improve tourism amenity value.
Preliminary prognosis - water quality and ecosystems

- No significant transboundary water quality problems are expected.
- Emergency procedures must be put in place to deal with possible spills.
- A more comprehensive assessment of the habitat that will be lost in the riparian zone of the Hou Sahong should be done.
Methods used

- “At site” hydrological measurements have been correlated with the daily discharges at Pakse to enabled a “synthetic” daily discharge time-series at the scheme.
- These estimates were used to prepare daily flow duration curves at ten sites within the various distributary channels associated with the Project.
- The selection of Pakse, is sound, since the incremental catchment is less than two percent greater.
- The Baseline for the Project is 1982 to 2009. This is comparable to the long term record (1923 – 2013).

Hydrology Summary

- Some 4% of total annual Mekong flow enters the Hou Sahong channel under existing hydrological conditions.
- This will increase post scheme, but a maximum of some 50% of the flow is expected to be diverted into the Hou Sahong in the dry season.
Transboundary flow regimes

- There are no changes to transboundary flow regimes.
- The cross border delivery of flow to Cambodia remains the same in volumetric terms, with no seasonal modification of the flow regime.
- There may be diurnal changes, but these would be inconsequential given that the pondage is just 1 km$^3$.

Preliminary prognosis – hydrology

- The hydrological studies for the DSHPP are comprehensive and based upon a sound methodology.
- However, it would be useful if the major hydrological results were succinctly summarized, specifically with regard to site conditions pre- and post development.
- It will be difficult to regulate the minimum flows of 800m$^3$/s over the Khone falls through operating the DSHPP.
Modelling Approaches

Computational hydraulic modeling has been undertaken to;
1. Understand the natural water levels and flows in the channels;
2. Determine the effects of channel excavation and hydropower operations on water levels, velocities and flow rates.

The evaluation is based on 15 discrete points on the flow duration curves that were estimated for each of the channels.
Models used

Two models were used;
• The Hou Sahong headwater model, and
• The Hou Sahong – Hou Xang Peuk tailrace model.

The headwater model was created using Mike 21, a two dimensional model, using a structured square grid of 5x5m. The tailrace model is a 1D model.

The design power-house discharge is set to 1,600 m³/s while ensuring that the flow available over the Khone Falls is 800 m³/s.

Key issues

The degree to which flows entering the Hou Sahong can be effectively managed is unknown. A gated control structure at the channel entrance which would serve a number of purposes;
• Ensuring the diversion to the Hou Phapheng;
• Flood management and the mitigation of extreme events;
• Control downstream fish and larval passage at critical times; and
• The exclusion of sediment bed load from the head pond.
(The present design calls for a submerged sill, the long term effectiveness of this is debatable.)
Preliminary prognosis – hydraulics

- Transboundary hydraulics were undertaken with a one-dimensional (1D) HECRAS model;
- The results show that flows into the western distributaries in Cambodia would increase, the central ones would stay the same and the eastern most ones would decrease.
- The trans-boundary impact studies undertaken thus far should be viewed as exploratory and the conclusions preliminary (due to 1D modelling).

Preliminary prognosis – Overall

The hydraulic modeling provides a comprehensive assessment. A number of issues and clarifications arise:

- It is doubtful whether the flows in the Hou Phapheng can be managed by scheme head-pond levels.
- This could be addressed through a gated control structure at the entrance to the Hou Sahong.
- The hydropower operator will have economic incentives during dry years to minimize the flows to the Khone Phapheng waterfall and in the alternative channels for fish migration.
Preliminary prognosis – Overall cont...

- The submerged weir to arrest bed load ingress into the head pond may function in the short term but not in the long term.
- The depth of excavation required to assure the design diversion of 1,600 m³/s into the Hou Sadong should prescribed and modelled before construction starts.
- The trans-boundary impact studies undertaken thus far, based on 1D modeling, should be viewed as exploratory and the conclusions preliminary.

SEDIMENT AND MORPHOLOGICAL IMPACTS
Dr George Annandale
Key Issues

• **Fourfold Increase in Sediment Discharge through Hou Sahong**
  – Due to increased Diversion Flows

• **Reservoir Sedimentation**
  – Reservoir filled with Sediment in 6 years

• **Reservoir Inlet Sedimentation**
  – May Reduce Inflows of Water from 1,600m$^3$/s to 340m$^3$/s or less.

Key Issues cont...

• **Continual Maintenance Requirement**
  – Continued Reservoir Sediment Management required to Sustain Power Production Goals

• **Disposal of Dredged Material from Reservoir Sedimentation Management**
  – Disposal into River
    • Increased Sediment Loads Pulses and impacts on Dolphin pool
    • Increased Turbidity Pulses
  – Limited Availability of Land for Disposal
Key Issues cont...

• **Limited Transboundary Impacts**
  — Down to Cambodia Border Only
    • Deep Pool Sedimentation
    • Turbidity Increase
    • Island Sedimentation in Cambodia

• **Insignificant Cumulative Impacts**
  — No Lasting Impact on Sediment Balance in Mekong River and Delta are expected.

Mitigation options

• **Develop an Effective Reservoir Sedimentation Management Approach**
  — Focus on Disposal of Sediment
    • Disposal on Land
      — How much material can be stored and for how long?
    • Disposal into River
      — Downstream impacts on sediment loads and turbidity?
      — Impact on Deep Pools and islands?

• **Devise Effective Reservoir Inlet Sedimentation Management Approach**
  — Sustain inflow at 1,600 m$^3$/s
Preliminary prognosis - sediment

- Transboundary Impacts
  - **No Impacts** due to changes in Sediment Load to
    - Morphology of Mekong River or
    - Morphology of Mekong Delta
  - **Potential** Transboundary Impacts may be immediately downstream requires investigation of
    - Dolphin Deep Pool Sedimentation
    - Turbidity impacts during flushing
    - Sedimentation at the transboundary Islands

Preliminary prognosis - sediment cont...

- **Hydropower Operational Difficulties**
  - Reservoir Sedimentation
    - Sediment to Cover Turbine intakes and abrasion Damage
  - Reservoir Intake Sedimentation will lead to
    - Reduction in Flow to DSHP Powerhouse and ability to Generate Power
  - Requires **Continuous** Reservoir Sedimentation Management
- **Other Potential Impacts**
  - Developer needs to demonstrate that Minimum Flows to Khone Falls can be ensured by managing flow through the DSHP
Navigation

Preliminary prognosis - navigation

The configuration of the Mekong Mainstream in the Don Sahong area forms a natural barrier to navigation, and the DSHPP will not change the freedom of navigation.

It is noted that there are long term plans to develop a series of navigation locks around the area.
Dam Safety

Preliminary prognosis – Dam Safety

- The flood flows analysis is adequate, and sufficiently rigorous.
- Hydraulic modelling of the headwater and tailrace systems is considered adequate for the purposes of designing and operating the hydropower plant.
- The Dam Safety issues are covered are generally in compliance with the PDG.
Use of Water Resources

- No potential adverse Transboundary Social Impacts (TSIs) for water users expected; as there will be no or minor changes concerning:
  - Water flow (upstream / downstream Siphandone Area);
  - Water quality (downstream); and
  - Sedimentation (downstream in Mekong River and Delta).
Fisheries

- *Potential adverse TSI* on fisheries (food, income activities, others), as there will be a change in fish migration and fish passes as migration routes;
- There is a *potential risk on socio-economic condition of fisheries in the LMB*, if fish passages are not implemented successfully; and
- *Potential soc.-econ. impacts* in different hydrogeographic and social zones of LMB. To assess when fisheries impacts are quantified.

Tourism

- *Potential adverse and negative TSI* on tourist activities, as there will be:
  - No change of the overall attraction of the Siphandone area, but increased accessibility to the Siphandone area through existing and new bridges; and
  - However, some “tourist spots” will be effected, such as:
    - the appearance of the Khone Water Falls will change partly; and
    - the dolphin watching site is located in the vicinity of the dam site.
Regional-Transboundary Planning

- Need for such a DSHPP Project perspective:
  - Project’s social safeguard monitoring and evaluation;
  - Project’s mitigating planning and implementation;
  - Consultations through Project owners with project stakeholders (in addition to others, such as MRC);
  - Regional development in the context of the Greater Mekong sub-region. Project’s infrastructure to be included gov. sub-regional development scheme;
  - Income activities and labour market; and
  - Others.

OVERALL PRELIMINARY PROGNOSIS
Overall transboundary impacts

1. There are *no significant* transboundary sediment or nutrient impacts on the Delta.
2. There are *no significant* transboundary water quality problems.
3. There are *no significant* changes in the cross border flows.
4. *Dam safety issues are adequately addressed.*
5. *Navigation is not relevant to the DSHPP.*
6. *Impacts on fisheries and fish passage are partial, but potentially significant.*
7. There is potential to increase the tourism potential of the region.

The main transboundary risks are...

- The effect of noise on the local resident dolphin population.
- The extent to which the modified channels compensate for the lost fish passage in the Hou Sahong.
- The impact lost aquatic habitat in the Hou Sahong.
- The reduced flow over the Khone Phapheng Falls and the possible loss of tourism amenity value.
- Possible rapid sedimentation of the head pond and the need for flushing.
These risks can be mitigated but not eliminated

A number of options to mitigate and minimize the impacts of the DSHPP have been proposed by the developer and the MRC Expert Groups.

However,

The optimal design of these measures and assessment of their efficacy needs further study.