The 6th Regional Stakeholder Forum

Second Regional Information Sharing on Pak Lay Prior Consultation Process

17 January 2019

Luang Prabang, Lao PDR

Second Draft Technical Review on Dam Safety

Mr. Palakorn Chanbanyong, Hydropower Development Specialist, MRC Secretariat

Contents of Presentation

1.

Background

2.

Main review findings

- *Site Geology*
- *Project Layout*
- *Failure Modes Assessment and Downstream Impacts*
- *Design Criteria*
- *Dam and Reservoir Operation*
- *Dam Safety Management*

3.

Consideration for MRC Joint Committee

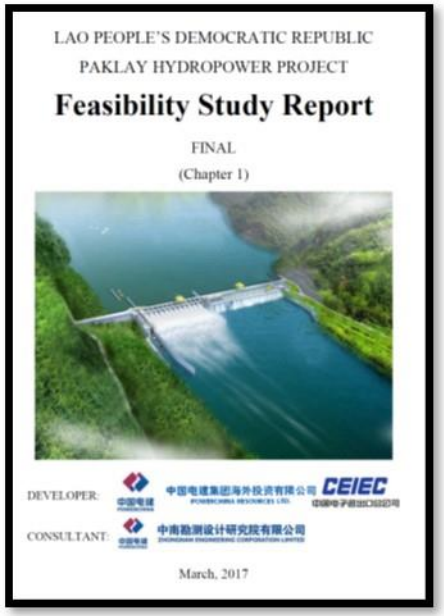
I. Background - Introduction

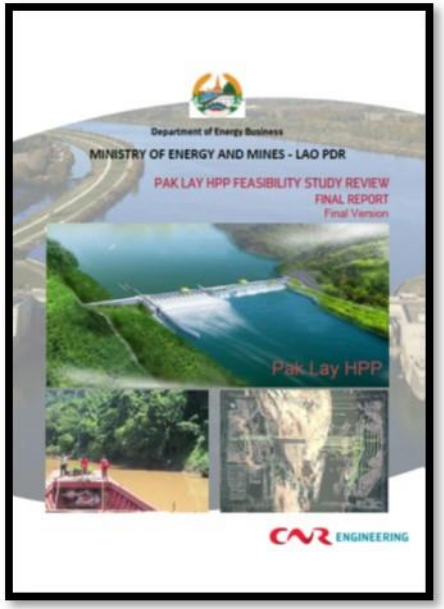
This section of the TRR addresses;

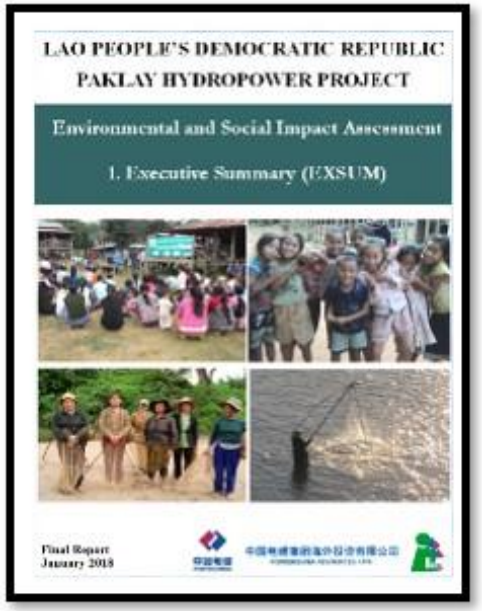
- Overall content of the PLHPP documents for dam safety measures;
- Comprehensive dam safety reviews;
- Emergency preparedness plan; and
- Other information on the safety of dams.

I. Background – Documents Reviewed

- **Pak Lay Hydropower Project Feasibility Study Report**, Final Report, March 2017, PowerChina and CEIEC
- **Pak Lay Hydropower Project, Environment and Social Impact Assessment**, Final Report, January 2018, PowerChina Resources Ltd
- **Pak Lay HPP Feasibility Study Review Final Report**, Final Version, January 2017, CNR Engineering







I. Background – Relevant Compliance and Guidance Documents

- ***Preliminary Design Guidance (DG2018 in final stages)***
- ***World Bank OP 4-37***
- ***ICOLD Bulletins***
  - *Bulletin 125 – Dams and floods*
  - *Bulletin 130 – Risk assessment in dam safety management*
  - *Bulletin 142 – Safe Passage of extreme floods*
  - *Bulletin 148 – Selecting seismic parameters for large dams*
  - *Bulletin 156 – Integrated flood risk management*
- ***Other Documents***
  - Laos Electric Power Technical Standards, LEPTS *(new revision in final stages of review)*
  - Laos Dam Safety Guidelines *(in preparation)*

MEKONG RIVER COMMISSION FOR SUSTAINABLE DEVELOPMENT
MRC

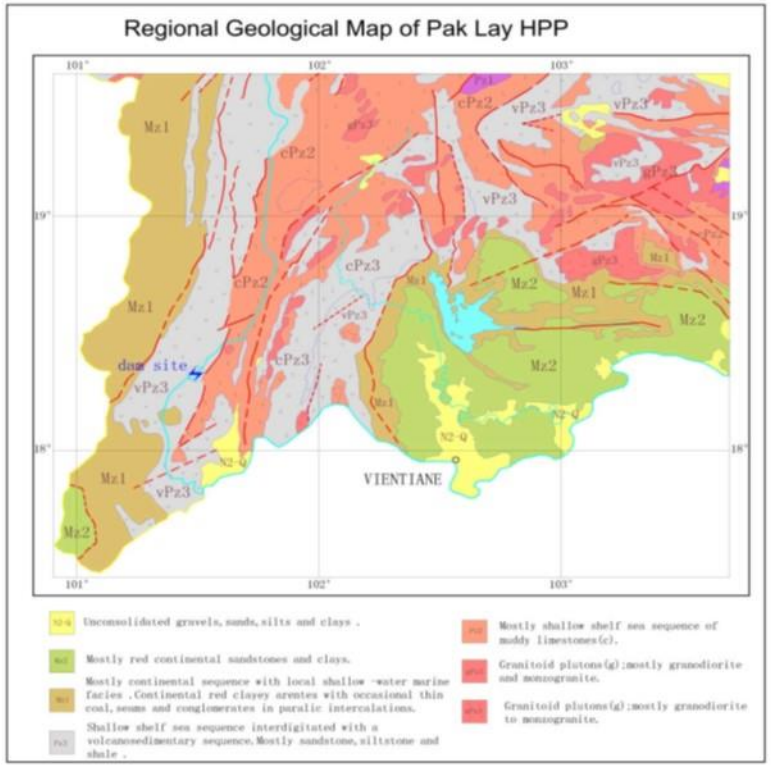
THE WORLD BANK

CIGB ICOLD

II. Main Review Findings – Site Geology

In general the geology is suitable for the proposed structure, however further clarification is sought on the following issues:

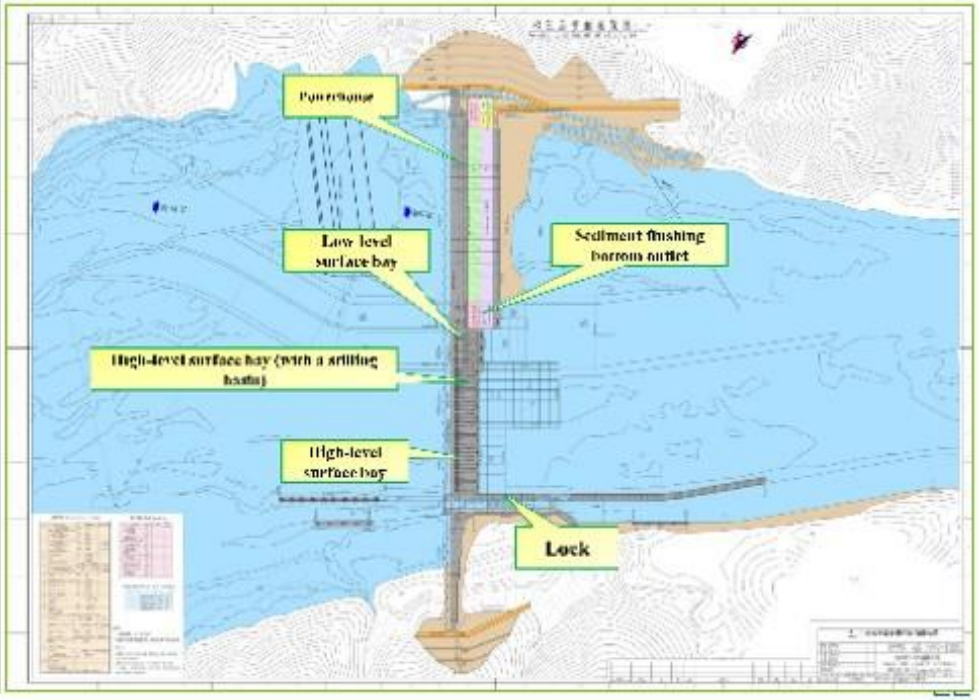
- **Limestone band in the reservoir basin** is not clearly identified - further information required to give confidence of water tightness
- A **clear geological description and discussion** needs to be provided for the upper (preferred) dam site
- The developer has identified that the **foundation has potential for seepage** under the dam and has provided a grout curtain
- There are **weak areas of the foundation where scour can be anticipated downstream of the flood gates**. Whilst rock cores seen during site visit indicate better rock that the report suggests, the extent of expected scour and the methods of mitigation should be reconsidered during the detailed design



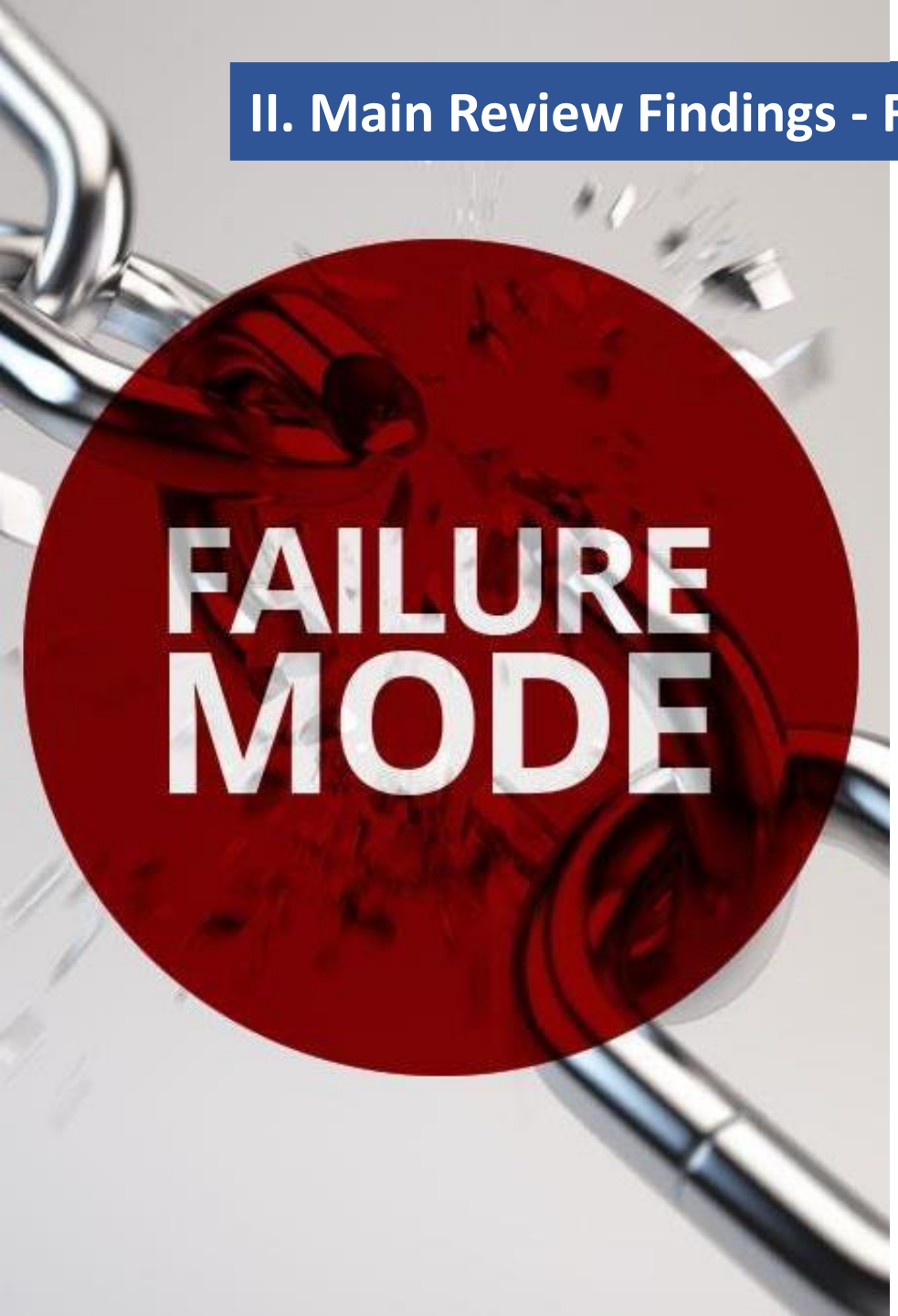
II. Main Review Findings – Project Layout

In general the overall layout of the proposed structures is adequate, however further clarification is sought in particular areas

- Important that **a final set of documents are prepared for the upper site and made available** → Avoid confusion in places and drawing
- The **feasibility study for Pak Lay should be updated to incorporate**, where relevant, the final design criteria and operational parameters for **Xayaburi HPP**.
- The Developer has used a **physical hydraulic model** to confirm the safe performance of the dam → **This report should be provided** as part of the prior consultation process.



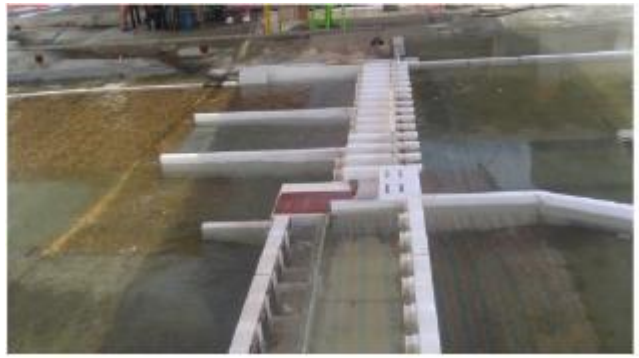
II. Main Review Findings - Failure Modes Assessment and Downstream Impacts



- Now, standard international dam safety engineering practice
- No specific section in the FSR regarding risk management of the hazards, site specific failure modes and the downstream impact of failure

Recommendation:

- The developer should **carry out a failure modes analysis at the start of the detailed design stage** to identify any weaknesses in the design and allow mitigation measures to be incorporated at an early stage.
- **Dam break modelling should be carried out** based on the failure modes review and an assessment carried out of the impacts of the theoretical dam break flood wave to identify the consequences of failure.



II. Main Review Findings – Design Criteria

Flood

- **The design (2,000yr) and check flood (10,000yr) flows are significantly lower than those used in the detailed design of the Xayaburi HPP (PMF)** → a consistent approach to the passage of extreme floods through any proposed mainstream dam (PDG, Clause 11)
- The PLHPP **should be designed to safely pass the Probable Maximum Flood**.
- The referenced guidance documents (ICOLD and LEPTS) require hazard assessment to select flood criteria – **the FSR does not carry out a hazard/consequence assessment for selection of the flood criteria**.
- The design flood for the energy dissipation and anti-scour structures is the 1 in 100 year flood. These structures are located on potentially weak areas of rock – **further details to be provided to confirm suitability of design**.

II. Main Review Findings – Design Criteria

Seismic

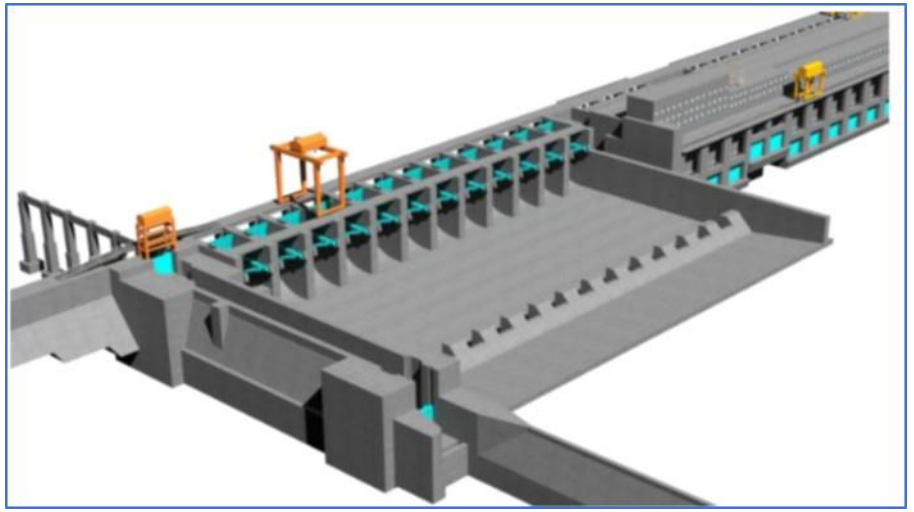
- Select **Return Period with a consistent approach** to the close MS projects
- The developer **should carry out a dam break consequence assessment** to provide further support to their selection of seismic design criteria.
- The developer **should provide a copy of the seismic hazard assessment** that supports the peak ground accelerations used in the design.

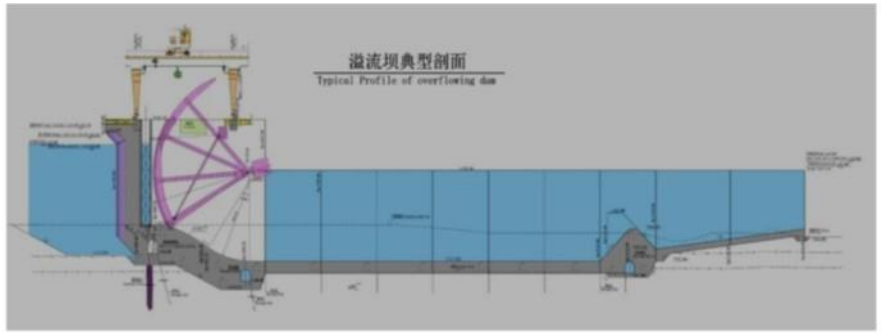
Structural Stability

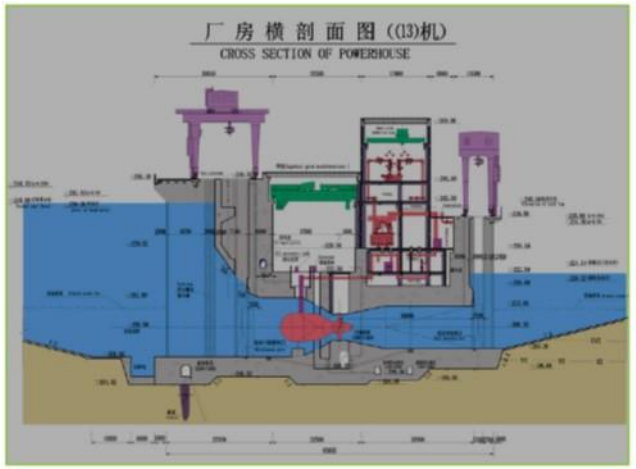
- **The structural stability assessments for the key components of the dam should be closely reviewed** as part of the scope of the Panel of Experts
- **The design approach to structural stability appears acceptable** → the design appears to rely upon a pumped drainage system to reduce the uplift pressure under all the dam components → the developer reconsiders the need for the foundation drainage during the detailed design stage.

II. Main Review Findings - Dam and Reservoir Operation

- **Emergency Preparedness** - **No clear maps showing the extent of inundation** due to the impoundment of the reservoir and **no maps to show the extent of downstream flooding, emergency planning should include the construction stage and consult with downstream stakeholders (including in Thailand)**
- **Dam Safety Monitoring System** – **this has not been designed based on a detailed failure modes assessment**, some of the proposed monitoring may not be effective in identifying the potential failure modes for the PLHPP → **Monitoring system should be reviewed/ optimised based on the failure modes**
- **The proposed operational strategy must be consistent** with the operation of other existing (or under construction) hydropower schemes on the Mekong → **Operational information Sharing**







II. Main Review Findings – Dam Safety Management

- Details of the proposed dam safety management system, including an Emergency Preparedness Plan have been made available → **In general, these appear reasonable for the feasibility stage of the project but need to include the construction stage and consult with downstream stakeholders**.
- Further areas that require development during the detailed design → **EPP, DS inundation mapping and Dam safety monitoring** targeted to a failure modes assessment
- Important that the developer ensures that their dam safety management system complies with the requirements of the **new Ministry of Energy and Mines dam safety guidelines**

III. Consideration for MRC Joint Committee

- **Need for the early appointment of the independent dam review panel** as recommended by the World Bank and the PDG.
- **Uncertainty over the suitability of the design criteria**
  - A dam break assessment must be carried out and a consequence classification must be established for the dam
  - The flood design criteria should be reviewed and upgraded if necessary for consistent approach to the safe passage of extreme floods through any proposed mainstream dam.
  - The seismic hazard assessment report must be provided in order to provide confidence that the Developer has used adequate seismic load criteria

Thank you