



# APPROACH AND METHODOLOGY FOR ASSESSMENT OF THE LUANG PRABANG HYDROPOWER PROJECT – DAM SAFETY AND NAVIGATION

THE FIRST REGIONAL INFORMATION SHARING ON LUANG PRABANG HYDROPOWER PROJECT  
06 NOVEMBER 2019, VIENTIANE, LAO PDR

Ms. Ton Nu Thi Thanh Yen, Navigation Operations Specialist, Planning Division, MRC Secretariat



# OUTLINES



**Scoping of the review**



**Preliminary findings**



**Proposed methodology**



**Further requested information  
and data**

# DAM SAFETY

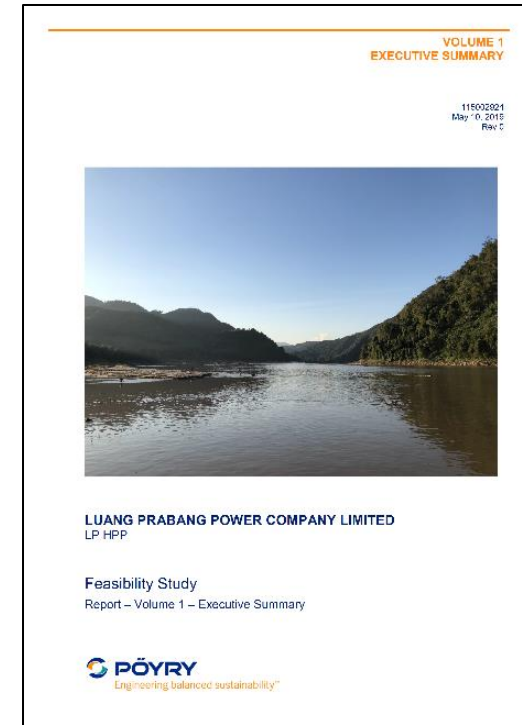
# Scoping of the review - Objectives

The Luang Prabang HPP is located approx. 25 km upstream of Luang Prabang. **Safety is important!**

The TRR provides an assessment of the Luang Prabang HPP Feasibility Study Report with respect to Dam Safety requirements.

This section of the final TRR will address:

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



# Scoping of the review – Reference

- ***Preliminary Design Guidance 2009 & draft 2019 (PDG2009 & draft PDG2019)***
- ***World Bank OP 4-37 (Safety of Dams)***
- ***ICOLD Bulletins (Dam Safety)***
- ***Laos National Documents***
  - Laos Electric Power Technical Standards, LEPTS (*new revision has been approved*)
  - Laos Dam Safety Guidelines



**THE WORLD BANK**



# Preliminary findings – Overall

The **Luang Prabang** FS makes reference to

- MRC PDG2009 / draft PDG2019 (June Version)
- Lao Electric Power Technical Standards
- ICOLD and the World Bank Guidelines



In order to address and cover following key elements;

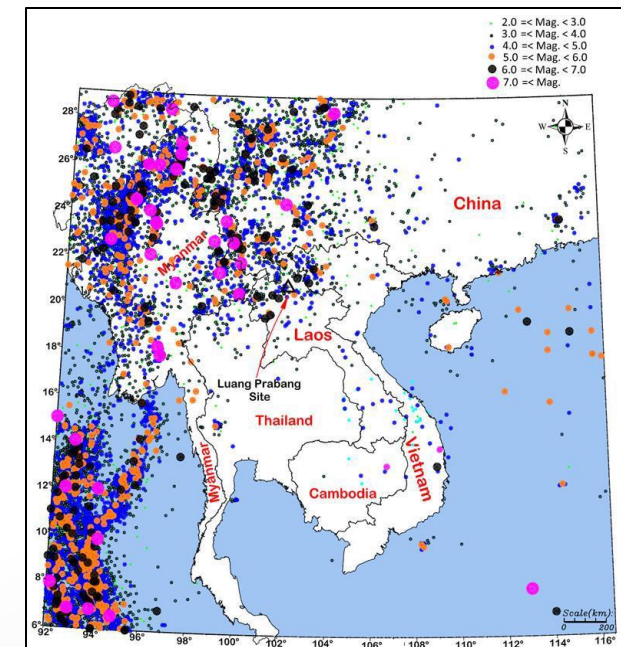
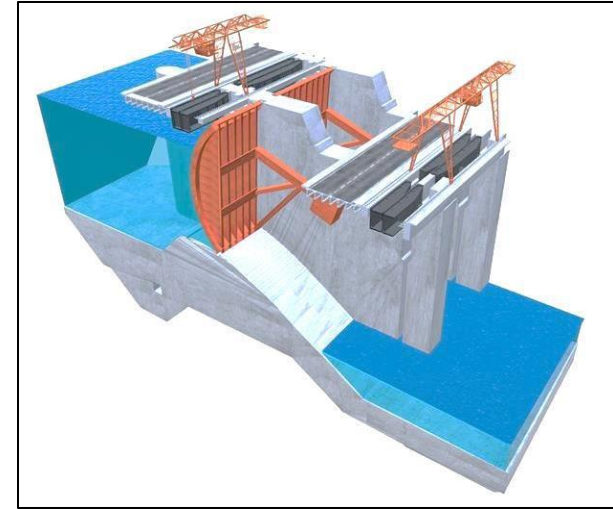
- (1) Structural Safety;
- (2) Dam Monitoring;
- (3) Operational safety and maintenance; and
- (4) Emergency Planning





# Preliminary findings – Design Criteria

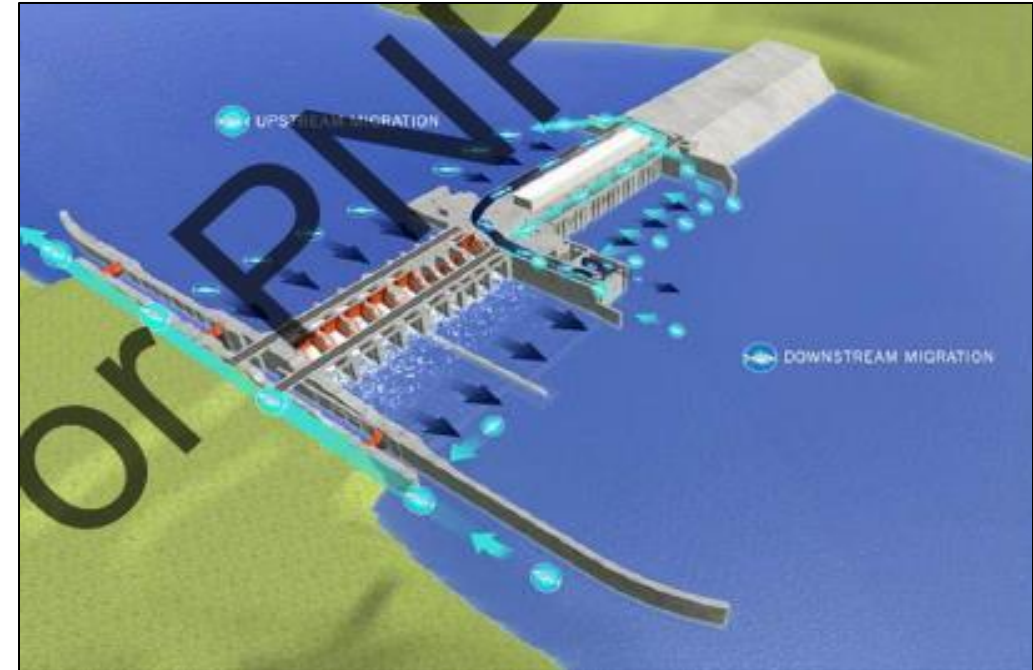
- The structures have been designed to withstand extreme seismic and flood events  
→ Probable Maximum Flood (PMF) and the Safety Evaluation Earthquake (SEE) which is the governing load case for the stability analysis and the structural design.
- However, the stability and stress calculations for the dam are not provided to demonstrate the safety of the dam under a range of loading scenarios.





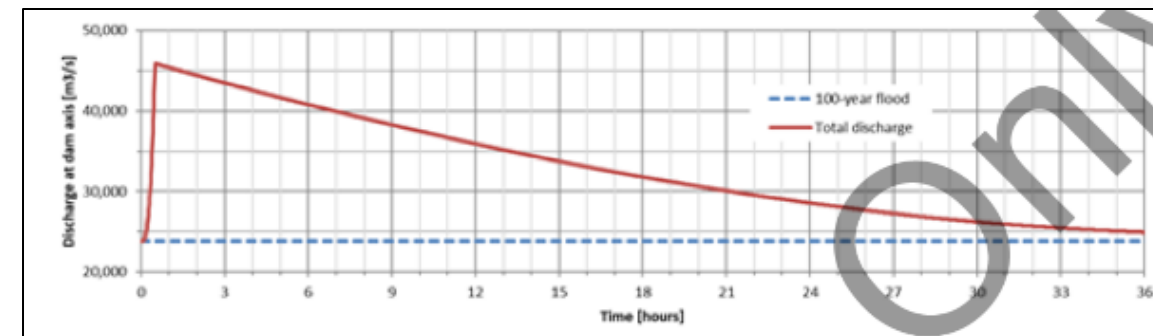
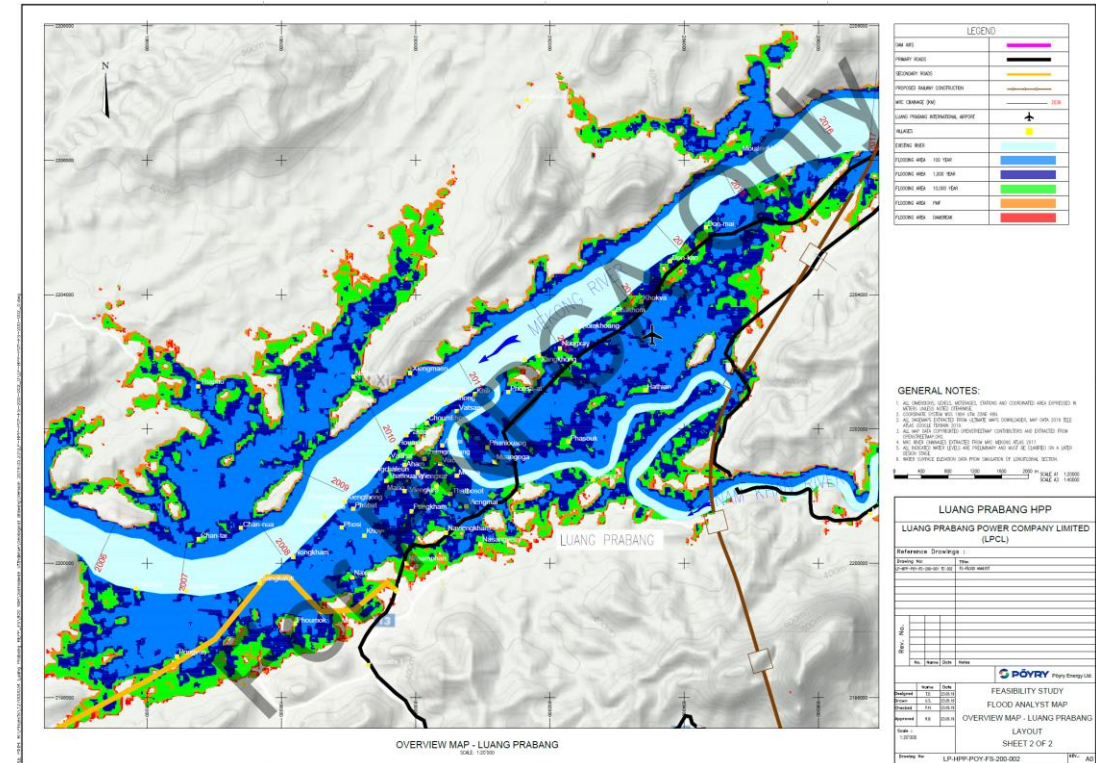
# Preliminary findings – Dam and reservoir operation

- Run-of-River type hydropower plant
- The Full Supply Level will be maintained most of the time during normal operation (0.5 m. for “operating range”)
- Increase of / decrease of the FSL might be required during spillway operation or other exceptional operating cases
- The reservoir scheduling for power generation and reservoir scheduling for floods (**Operation Rule Curve**) are not provided in the FSR.



# Preliminary findings - Failure Modes Assessment and Downstream Impacts / Dam Safety Management

- A Dam break analysis has been carried out and Downstream flood inundation maps have been prepared which will be further used as the basis for the Emergency Action Plan.
- A detailed Potential Failure Modes Assessment (PFMA) to identify credible failure modes for the dam and appurtenant structures is not provided.
- A detailed safety monitoring system is proposed. However, the developer's responsibility for all cost associated with implementing the dam safety and emergency response aspects, including the provision of budgets and covering the design, implementation and operation stages, is not clearly mentioned in the FS.



# Proposed methodology

- To review the safety design of dam as described in the FSR as well as observation during field visit and discussion with Developer during meetings in order to draw attention to any non-compliance with **PDG2009 and LEPTS**;
- To provide recommendations on actions that could help to improve the design and operations to ensure a closer match with the MRC PDG2009 and draft PDG2019; and
- To identify and provide recommendations related to any other issues requiring follow-up so that priorities can be readily established for improvement, remedial measures, or additional investigations.

# Further information and data requested

- More clarification on the Establishment and reviews by **an independent panel of experts**, and A **construction supervision and quality assurance plan**;
- The **stability and stress calculations for the dam** to demonstrate the safety of the dam under a range of loading scenarios;
- **All costs associated with implementing the dam safety aspects in the project budgets** to ensure this issue is taken into account under project developer's responsibility;
- **Both Cascade Joint Operating Rules and Project-Specific Operating Rules** to ensure dam safety risks are mitigated;
- The **detailed Potential Failure Modes Assessment (PFMA)** to identify the credible failure modes for the dam and appurtenant structures;
- Information on the **Flood Forecasting and Warning System** to provide warning for all people within the inundation areas identified by the flood modelling and mapping.
- Information on **preliminary operation and maintenance (O&M) plan**

# NAVIGATION

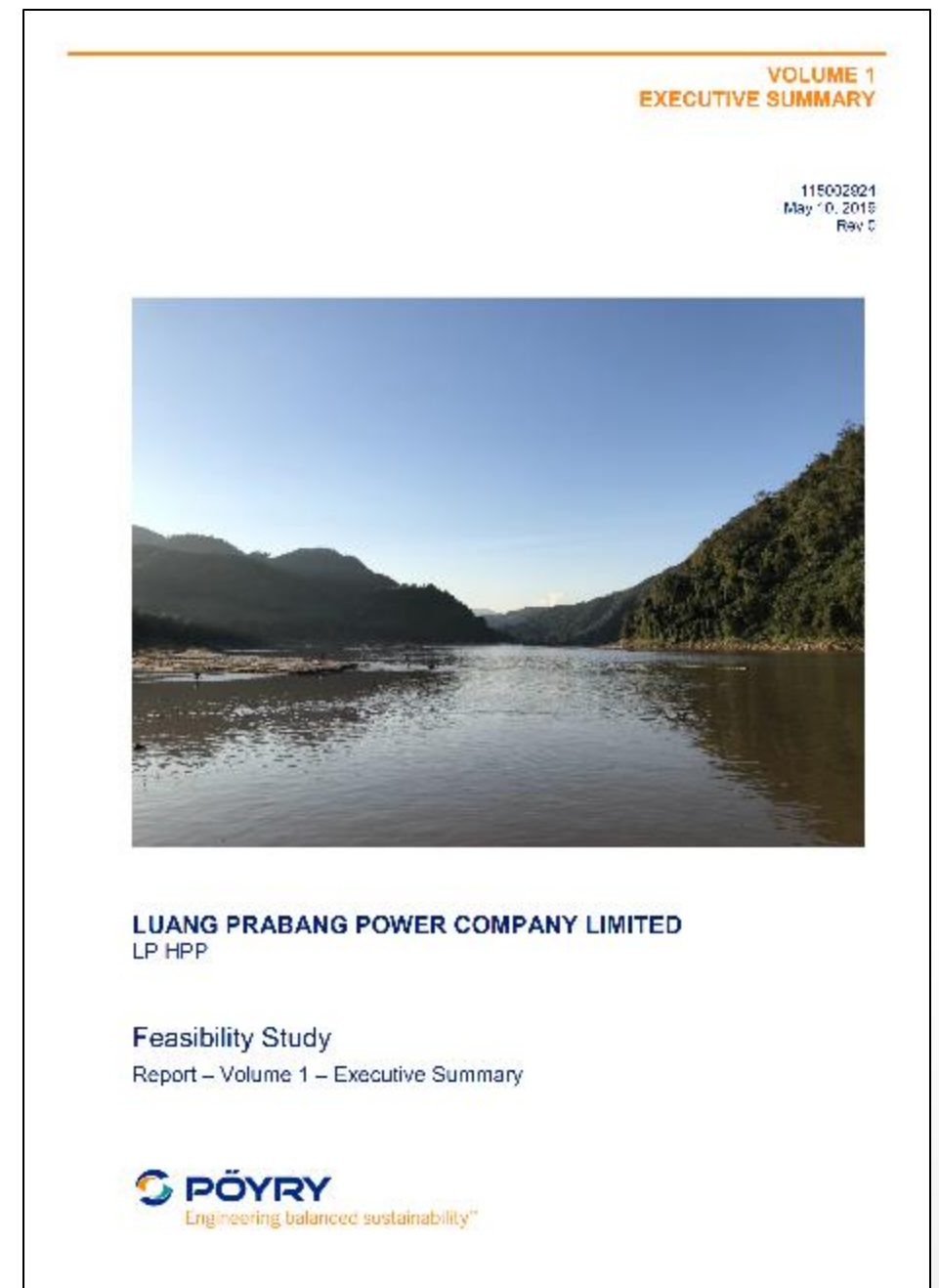
# Scoping of the review

To review the Luang Prabang HPP Feasibility Study Report with the following following items:

- Navigation structure design
- Filling and Emptying system
- Lock equipment
- Upstream and downstream approach channels
- Operation, safety and maintenance.

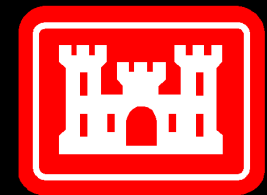
Information can be found in the Main report:

- Chapter 11.4: Operation of the Navigation Lock
- Chapter 12.5: Hydraulic Design of Navigation Lock
- Chapter 13.2: Civil Engineering- Navigation Lock
- Chapter 15.2: Hydro-Mechanical Equipment- Navigation Lock



# Scoping of the review – Reference

- MRC’s Design Guidances for Mekong Mainstream Dams in the Lower Mekong Basin (PDG2009; draft PDG2019 as the final draft);
- The MRC study “Review of International Ship Lock Dimensions and their Relevance to the Proposed Hydropower Developments on Mekong Mainstream dams”;
- PIANC (World Association for Waterborne Transport Infrastructure) report: “Final Report of the International Commission for the study of Locks.”
- PIANC report nr. 106-2009: “Innovations in navigation lock design”
- Various worldwide best practices such as studies conducted by USACE
- Various internet websites dealing with ship locks, river navigation, gates and valves for ship locks etc.;



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# Preliminary findings (1)

- Article 9 of the 1995 Mekong Agreement (freedom of navigation along the Mekong River, **not to pose an additional obstacle**) - provide for the construction of navigation locks
- The **dimensions of lock chambers have been followed**, including the provision for future doubling of the locks:
  - a one-way, two-step ship lock
  - a space for the ship lock for **upgrading into a double-way** lock is reserved.
  - **maximum working head of the navigation lock is 35.50 m**
  - the size of the lock chamber: **120 m long × 12 m wide × 4 m deep.**
- **The emptying/filling system** is designed to conform to requirements for maximum transit times of less than **50 minute.**



## Preliminary findings (2)

- Lockage time will be kept to a minimum, consistent with safe operation, safe movement of vessels in and out
- **Straight alignment** to allow for the safe entry and exit of vessels
- The access channel can generally accommodate **two standard vessels of 500 tons.**
- Long-term nature of planning and investment for navigation locks is considered with a view of **up to 50 years**
- The ship lock can be used **as additional fish passage.**
- **Access to ground structures** for maintenance and operation, access for emergency response is considered

# Proposed methodology

- Review the feasibility Report with particular focus on the navigation ship lock and approach channels
- Carry out the field visit
- Discuss with relevant Hydropower Dam Designers and Government officers for any non-compliance with MRC PDG 2009/draft PDG2019
- Compare with similar cases, best practices (as to compile recommendations)

# Further information and data requested

The review looks at the following issues and verifies if:

- **lockage of vessels in a safe and efficient manner**
- **lock gates and their manoeuvring devices** are protected in case of a fire inside the chamber
- **operation system:** at least 12 hours a day, every day and
- **maintenance:** not more than 9 days/year
- **future doubling of the locks is** designed
- **passage of small craft and family boats** is considered
- **during the construction:** minimized the suspended time and additional cost
- solutions to minimize **environmental impact** and for fine **material sedimentation**
- **emergency access** to both sides of each lock complex
- hydraulics (currents), river morphology (sedimentation) and wind exposure considered



**THANK YOU**

*One Mekong. One Spirit.*