

OROVILLE COMPREHENSIVE NEEDS ASSESSMENT

Independent Review Board Memorandum

DATE: March 15, 2019

TO: Mr. Sergio Escobar, Project Manager
Oroville Comprehensive Needs Assessment
California Department of Water Resources

FROM: Independent Review Board for
Oroville Comprehensive Needs Assessment

SUBJECT: Report No. 4

On Thursday March 14, 2019, the Independent Review Board (IRB) met at the Department of Water Resources (DWR) Oroville Field Division Office Main Conference Room at 9:00 am for briefings regarding progress on the Comprehensive Needs Assessment (CNA). The IRB met with representatives from the DWR Division of Engineering (DOE), DWR Division of Operations and Maintenance (DOM), Division of Safety of Dams (DSOD), the Federal Energy Regulatory Commission (FERC), and industry consultants working on the CNA to discuss:

- Progress on the FERC Level 2 Risk Assessment workshops,
- Progress on defining project CNA needs, objectives, considerations and constraints,
- The CNA evaluation criteria and process,
- Final Report and Task-Level Report Outlines,
- The IRB Comment Log and status of the IRB recommendations, and
- Open discussion of the status of the CNA study.

During the morning of Friday March 15, 2019, the IRB deliberated and prepared a draft of this report. Comments made on the individual presentations and the IRB's responses to DWR questions for the IRB are included in this report. A reading of the IRB's draft report was made to representatives from DWR, DOE, DOM, DSOD, FERC, and industry consultants working on the project at 12:00 pm. The meeting was adjourned following the reading of the report.

All IRB members were present on both days including (Elizabeth) Betty Andrews, Lelio Mejia, Bruce Muller, Dan Wade and Paul Schweiger. A list of meeting participants for both days is attached.

QUESTIONS FOR THE IRB

1. Does the IRB have any recommendations or comments on the Part 12D Level 2 briefing?

Response

The IRB appreciated the CNA Team's presentation on the FERC Level 2 Risk Analysis (L2RA) for the Oroville Dam Complex that is being conducted in conjunction with the FERC Part 12D Safety Inspection of the facilities. The presentation provided a clear and thorough overview of the background for the FERC Part 12D inspection, the L2RA, and the CNA Existing Condition Assessment.

The L2RA of the dam facilities was mandated by the U.S. Congress (HR 5895 Conference Report of September 20, 2018) and the plan for conducting the L2RA was approved by FERC. The process involves an unprecedented level of effort in conducting workshops attended and facilitated by multiple internationally- and nationally- recognized dam safety experts and is taking significantly more time to complete than initially anticipated.

The IRB is pleased that the CNA Team is proceeding with a preliminary risk assessment of the existing condition in parallel with the L2RA to avoid delays in the CNA study schedule, which otherwise would have resulted from the L2RA schedule extension. The CNA Existing Condition Assessment is being made using a semi-quantitative risk analysis (SQRA) approach, similar to that used for the L2RA.

Although the CNA Existing Condition Assessment and L2RA will be on separate paths, both studies will be based on the same factual information about the characteristics of the facilities and the hydrological and geological site conditions. Nonetheless, the CNA Team recognizes that the results of the two efforts might show apparent differences and plans to take advantage of the work done to date on the L2RA and reconcile the results as the studies progress. Thinking ahead about the strategy to reconcile the results of the studies, to account for possible

apparent differences in the outcomes, and how to communicate the results to broader audiences would serve the CNA study well (see response to Question 3).

The IRB noted that Steven J. Rigbey (member of the independent forensic team for Oroville Dam) has given significant thought to improving the implementation of the PFMA process. He has proposed using International Commission on Large Dams (ICOLD) Bulletin 154 principles as a systematic method for identifying failure modes of dams. A pre-publication copy of his paper was provided to the CNA Project Integration Team for consideration. The paper, "*Oroville in Retrospect: What Needs to Change?*" will be presented at the 2019 ICOLD Annual Meeting/Symposium in Ottawa, Canada. The IRB suggests that the CNA Team consider such recommendations for the existing condition assessment.

The IRB notes that, as agreed between DWR and FERC, the 10th Part 12D Safety Inspection of the Oroville Dam Complex will not include the Emergency Spillway and Flood Control Outlet Chute, which were retrofitted after the 2017 incident. The design and construction of the retrofit of those facilities has been the subject of review by a separate independent Board of Consultants.

2. Does the IRB have any recommendations or comments on the needs/objectives/ considerations/constraints?

Response

The IRB recognizes that the CNA Team has made significant progress since the last meeting to simplify and clarify the Task Needs Statements, Task Measure Development Objectives, Project Objectives, Project Considerations and Project Constraints. The IRB finds it helpful that the CNA Team has established consistent Needs Statements for all CNA Tasks and that Project Objectives are defined within the framework of the DWR Division of Operations and Maintenance Asset Management Risk Matrix and methodology for managing the portfolio of facilities in the State Water Project. The IRB believes that using this framework as a basis for Project Objectives will help to facilitate a common understanding within DWR and among its stakeholders for evaluation of alternative plans considered for the Oroville Dam Complex within the broader context of the State Water Project.

The IRB also finds it helpful that clear distinctions have now been made between Project Objectives and Project Considerations, as well as distinctions between "hard" and "soft" constraints. The IRB understands that constraints are relative to

a particular scenario and may ultimately change from “hard” to “soft” depending on the particular measure or alternative plan under evaluation.

During the meeting, the IRB provided some editorial suggestions related to the CNA study terminology for consideration by the CNA Team. Based on discussion between the IRB and the CNA project managers it was agreed to change the term “Project Objectives” to “Plan Formulation Principles” going forward.

3. Does the IRB have any recommendations or comments on the evaluation criteria/process?

Response

The IRB is pleased with the development of the evaluation framework and considers the framework to be appropriate for use as the CNA Team moves forward with the evaluation of measures and alternatives. During the meeting the IRB provided some editorial suggestions for the presentation of the risk evaluation framework for consideration by the CNA Team.

The proposed strategy to move forward expeditiously with a preliminary risk assessment of existing conditions for CNA purposes is appropriate and necessary due to the broader scope required for the CNA study. Although it may have been ideal for the Level 2 Risk Assessment (L2RA) required by FERC to be completed prior to moving forward with the CNA scope of work, it is certainly not necessary to do so and would create a significant delay to the CNA project schedule and loss of momentum if the CNA Team were to wait for the L2RA work to be complete.

The IRB understands that the CNA preliminary risk assessment will be informed by the Probable Failure Modes (PFMs) and risk assessments developed to date through the L2RA process as a starting point for estimation of risk, especially for the public safety consequence category. In addition, the CNA Team will also develop risk estimates and probabilities for other consequence categories that are part of the CNA evaluation framework for a range of loading conditions for each PFM. Since the CNA task leaders will continue to be engaged in the ongoing L2RA process, any PFMs that were not initially considered or developed by the CNA Project Team can be incorporated into the CNA process prior to finalization of the CNA scope of work. **The IRB recommends** that a clear strategy be developed to determine how CNA preliminary risk assessment work will be checked for consistency with L2RA results prior to completion of the CNA. The

strategy should include a process by which adjustments can be made to the CNA, if necessary.

The IRB understands that the Task Teams will be using the following general process to develop the information necessary for evaluating existing conditions and developing measures and alternatives:

- Review identified PFMs for the existing facilities and conditions
- Add additional failure modes developed by each task team
- Consolidate and screen out PFMs as appropriate
- Conduct the Preliminary SQRA for the remaining PFMs under existing conditions
- Brainstorm measures that will improve conditions through risk reduction
- Screen measures for fatal flaws that would eliminate measures from further consideration
- Conduct SQRA for each PFM for each measure over the range of loading conditions to be evaluated for each consequence category

The IRB understands that each Task Team may start with a large number of PFMs and will be tasked with initial screening of PFMs, resulting in a subset of PFMs that will be carried forward and further developed as part of the preliminary risk assessment. **The IRB recommends** that a process be developed to ensure that the initial screening of PFMs be done in a consistent manner across all tasks.

The IRB agrees that it is very important to assess each PFM that is carried forward into the preliminary risk assessment to be evaluated under a broad range of loading conditions (not just the extremes) to help assess risk for both extreme rare loading conditions that could occur as well as loading conditions that are not as extreme, but could have a greater likelihood of occurrence. This will allow for development of risk curves for each consequence category over a range of loading conditions that will be very useful in helping to establish the most effective measures to mitigate PFMs.

The IRB also understands that each Task Team will generate a significant number of measures for reducing risk. Each Task Team will initially screen the measures, resulting in a subset of measures that will be carried forward and assessed for risk reduction. **The IRB recommends** that a process be developed to ensure that the

screening of risk reduction measures is done in a consistent manner across all tasks.

The IRB recognizes the significance of the database application tool that was developed and deployed for the CNA preliminary risk assessment to help manage information in a consistent manner across all Task Teams. The IRB views this tool as very useful for documentation purposes. It will also provide an effective way to allow queries of the database for the purpose of presenting results graphically to qualitatively evaluate risk in terms of likelihood and consequences in a variety of ways for the five consequence categories and broad range of loading conditions for each PFM considered. This, in turn, will allow for the Task Teams to efficiently identify the most effective measures to elevate to the Project Integration Team.

The IRB anticipates that various stakeholders may advocate to extend the CNA evaluation framework to include criteria that are beyond the CNA scope which is intended to be consistent with the DWR asset management framework. Although there are certainly valid and important issues to consider for final selection of alternative plan(s) to carry forward into actionable plans after the CNA is complete, the IRB judges that the current evaluation framework is appropriate for purposes of presenting CNA alternative plan(s) for further consideration. The IRB understands that DWR leadership will need to enter into a decision-making process that would take place after the CNA is complete that may incorporate additional criteria, as appropriate, for final decision-making on alternative plan(s).

4. Does the IRB have any recommendations or comments on the Task 4 update?

Response

Significant progress was made by this Task Team. The Team has reached out to the Oroville Field Division to understand and document key information about the operation of the Hyatt Power Plant and its ability to contribute to releases during both flood and emergency evacuation events. The Team has also begun documenting the physical constraints related to the consideration of measures to increase low level outlet capacity to improve the ability to lower the reservoir elevation in a timely manner in the event of an emergency.

The IRB appreciates the preparation of a document to address recommendations M01-12 and M02-06. The IRB wanted to assure a clear understanding of the importance of the Hyatt Power Plant to emergency evacuation of the reservoir and

bulk electrical system. The report highlights the investments made by PG&E to improve the reliability of the bulk electric system that receives the power generated by the Hyatt Power Plant. The report also identifies two other potential electrical loads (station service and “islanding”) that could provide a limited backup load for the Hyatt Power Plant. While the discussion of “islanding” was discounted due to the limited amount of water stored in the Thermalito Afterbay, use of the Thermalito bypass valve to release pumped water back to the afterbay might partially mitigate this limitation.

The IRB notes that although recommendations M01-12 and M02-06 focus on providing artificial power demand to allow energy dissipation so that the grid demand will not be the limiting factor for powerhouse outlet capacity during a flood event, the recommendation also applies to other non-flood events that could require emergency evacuation of the reservoir.

The team for Task 4 has demonstrated significant momentum in developing the necessary information for the CNA analyses to be performed. It would appear from the presentation that there is a substantial body of information which could be used to begin preparing the background sections of the Task Report.

5. Does the IRB have any recommendations or comments on the task-level report outline?

Response

The master task-level report outline presented is comprehensive and well organized. The IRB believes the master report outline will serve as a plan that will help each Task Team stay on track and complete their scope of work. The IRB agrees with the emphasis on providing context and background information throughout the report, including providing detailed summaries of existing conditions, previous investigations, assumptions made to complete task efforts, and documenting what is working well pertinent to the task. The IRB encourages each Task Team to develop the outline for their report using this master outline and to begin writing sections of the report as soon as possible. Based on the progress update for Task 4, substantial portions of the report for this task can be completed.

6. Does the IRB have any recommendations or comments on the final report outline?

Response

The final report outline is also thoughtfully developed and comprehensive. Preparing the report will be a significant effort. The IRB commends the CNA Team for dedicating a professional with advanced skills in preparing technical reports to manage the development of the report for this project. The IRB encourages the CNA Team to complete sections of the report as the work is completed. **The IRB recommends** that DWR consider preparation of a parallel final report based on non-critical energy infrastructure information (CEII) which could be released to the public without the need for redaction.

7. Does the IRB have any recommendations or comments on the IRB Comments Log?

Response

The IRB reviewed the Comment Log and entered the status of each recommendation based upon the information provided in presentations to date. The IRB Comments Log is up to date.

8. Does the IRB have any other recommendations or comments?

Response

The IRB looks forward to hearing about the following topics at the next IRB meeting:

- Results from the CNA preliminary SQRA and the L2RA
- Progress reports for CNA Tasks
 - Identification of measures for risk reduction
 - Identification of any measures screened out from further consideration
 - Progress in completing those portions of the task reports providing process and background information

Concluding Remark:

The IRB appreciates the enthusiasm demonstrated by the CNA Team and the progress that has been made. The IRB believes the CNA Team has defined a clear path forward and is picking up momentum. The IRB looks forward to seeing the results from each teams' evaluations.

IRB RECOMMENDATIONS SUMMARY

- M4-1 The IRB recommends that a clear strategy be developed to determine how CNA preliminary risk assessment work will be checked for consistency with L2RA results prior to completion of the CNA. The strategy should include a process by which adjustments can be made to the CNA, if necessary.

- M4-2 The IRB recommends that a process is developed to ensure that the initial screening of PFM's is done in a consistent manner across all tasks.

- M4-3 The IRB recommends that a process be developed to ensure that the screening of risk reduction measures is done in a consistent manner across all tasks.

- M4-4 The IRB recommends that DWR consider preparation of a parallel final report based on non-critical energy infrastructure information (CEII) which could be released to the public without the need for redaction.

Respectfully submitted,



Betty Andrews



Lelio Mejia



Bruce Muller



Paul Schweiger



Dan Wade