CNA Task 4 – Low-Level Outlet Alternatives
Work Progress Briefing

Oroville Dam Safety – Ad Hoc Committee Meeting No. 3
January 10, 2019
CNA Task 4 Work Progress Briefing

Presentation Outline

- Defining Needs Statement, Objectives, Constraints
- Summary of Task 4 Objectives and Constraints
- Examples of Specific Evaluations Required
- Additional Task 4 Updates:
  - Reservoir Drawdown Calculations
  - Seismic Shaking Estimates for Hyatt PP
  - Potential Reservoir Drawdown Limitations/Benefits
CNA Planning Project Approach

1. Identify needs, constraints, and measures to address needs

2. Inventory current and forecast future conditions

3. **Formulate** alternative solutions (plans)

4. **Evaluate** alternative solutions (plans)

5. **Compare** alternative solutions (plans)

6. **Recommend** solutions (plans)
Phase I - Identify

1. **Needs** that arise due to the baseline condition.

2. **Objectives** that are measurable and actionable targets to be met with *measures* and alternative *plans* (combinations of measures)

3. **Constraints** that limit or restrict action taken to address needs or opportunities
Hyatt Power Plant

- 550-foot-long,
- 137-foot high
- Excavated cavern
Effectively, no release capacity when lake is below ~Elev. 640 feet
River Valve Outlet System (RVOS)

- Two 6-foot diameter pipes/valves through plug in Diversion Tunnel No. 2
- Maximum Capacity ~4,000 cfs
- Valve reliability
Task 4 Need Statement

Are additional outlet facilities needed to provide redundancy or additional reservoir drawdown capacity at Oroville Dam?

Objective T4-1 – Determine whether new outlet facilities should be added to enhance redundancy to the FCO Gates for Emergency Reservoir Drawdown of the Upper Reservoir.

Objective T4-2 – Determine whether new outlet facilities should be added to enhance redundancy to the Hyatt PP for Emergency Reservoir Drawdown of the Lower Reservoir.

Objective T4-3 – Determine whether new outlet facilities should be added to provide additional capacity for Emergency Reservoir Drawdown of the Lower Reservoir.

Objective T4-4 – Determine whether new outlet facilities should be added to provide additional capacity for routine reservoir operations of the Reservoir (likely focused on the Lower Reservoir releases).

Constraints

• Physical limits of Existing Facilities
• Reliability of Existing Facilities
• Tolerable risk
• Regulatory requirements
• Additional physical constraints (e.g. channel capacity, geology, operations)
Example Evaluation #1:
Objective T4-3 – Additional Capacity for Emergency Reservoir Drawdown Capabilities for **Lower Reservoir**

**Not Known:** What risks we are trying to mitigate in providing **additional** Emergency Reservoir Drawdown capacity, to what elevation might this be important, and whether DSOD Criterion #2 is the appropriate amount and rate of drawdown with respect to Tolerable Risk.

**Evaluation:** Interview Task Leaders/Teams for Task 3 and 5 to determine risks and potential reservoir drawdown mitigation, identify possible risk reduction benefits. Participate in upcoming PFMA and Level 2 Risk Analysis.
Example Evaluation #2:
Objective T4-1 - **Redundant** Capacity for Emergency Reservoir Drawdown for Upper Reservoir

**Not Known:** What are the requirements by FERC and DSOD for **redundancy** in providing Emergency Reservoir Drawdown Criteria for the **Upper** Reservoir?

**Evaluation:** Meet with FERC and DSOD staff to discuss their potential requirements with respect to **redundancy** in drawing down the upper portion of the reservoir. Discuss the specific issues, risks, and potential risk reductions with respect to Oroville Dam and the draw down capabilities for the **Upper** Reservoir.
Example Evaluation #3:
Common for Objectives T4-1 to T4-4 – Consider the potential use of existing Diversion Tunnels

Not Known: Whether we can use one of the existing Diversion Tunnels as a new LLO.

Evaluation: Develop cursory level measures that use one of the existing diversion tunnels, identify requirements for hot tap of the reservoir, new valve chambers, facilities to isolate the diversion tunnels from the Hyatt PP during releases, and ability to maintain facilities. Evaluate whether this approach contains any fatal flaws.
Max. Drawdown under Existing Conditions:

- Assumes all 8 FCO Gates fully open
- All 6 units online in Hyatt
- RVOS at full capacity
- Inflow assumption is a constant 5,000 cfs.
Oroville Reservoir Inflow

Source: Oroville drawdown calc3.xlsm (CDEC Daily Inflow Jan 1, 2003 - Jan 1, 2013)
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Additional Task 4 Updates

Upper Reservoir Drawdown Calculations

**Drawdown under Existing Conditions:**

- Assumes only discharge from FCO gates
- No discharge from Hyatt or RVOS
- Constant inflow is 5,000 CFS
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Additional Task 4 Updates

Reservoir Drawdown Calculations – Hyatt PP Only

Drawdown under Existing Conditions:

- Assumes only discharge from Hyatt
- No discharge from FCO or RVOS
- Constant inflow is 5,000 CFS
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Additional Task 4 Updates
Potential Reservoir Drawdown Limitations/Benefits
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Additional Task 4 Updates

Potential Reservoir Drawdown Limitations/Benefits

Probability of lake elevation falling below the LLO in any given year.

<table>
<thead>
<tr>
<th>Month</th>
<th>LLO - 340 feet</th>
<th>LLO - 550 feet</th>
<th>LLO – 680 feet</th>
<th>LLO – 700 feet</th>
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Lake Oroville Water Operations Benefit of a Low-Level Outlet

- In the event of a series of extreme dry year(s) a LLO would provide access to water supply at elevations lower than the Hyatt intakes and at a greater capacity than that provided by the RVOS...at lower elevations. The table shows the CALSIM results of the probability of lake elevation for each month falling below the LLO.
- Elevation 550 feet was chosen because it represents the same elevation as the Palermo Canal intake, which is being assessed for a cold-water project.

Operations modeled over 81 years of historical hydrology.
Seismic Shaking Estimates for Hyatt PP

Preliminary Draft Report by LCI, November 2, 2018

Objective: Provide preliminary estimates of ground motions for use in risk assessments of underground Hyatt Power Plant

Approach: Performed simplified 1D dynamic response analyses

Results: Recommended following Site Amplification Factors:

- For low frequency motions (1 Hz or less) assume an SAF = 1
- For high frequency motions (>20 Hz), assume an SAF = 0.67
- For frequencies in between 1 and 20 Hz, use linear interpolation (e.g. for 5 Hz, or Period = 0.2 sec), use SAF = 0.82.
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Additional Task 4 Updates

Seismic Shaking Estimates for Hyatt PP

Left Abutment PGA Estimates from 2018 DWR Updated Faulting and Seismicity Study

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<th>Event</th>
<th>Median</th>
<th>69th Percentile</th>
<th>84th Percentile</th>
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* PGA (g) values for different return periods and seismic events.
Next Steps

✓ Finalize Identification of Needs, Objectives, and Constraints Table

✓ Finalize Identification of Assignments to Complete Evaluations

✓ Begin Identifying Potential Measures to Address Objectives

✓ Participate in Upcoming PFMA and Level 2 Risk Analysis
Questions?