Prioritization of State Water Project Spillway Inspections

David Sarkisian, PE, CEG
SWP Chief Dam Safety Engineer
Division of Operations and Maintenance
California Department of Water Resources
State Water Project Overview

- Largest state owned and operated water delivery system in the U.S.
- Serves 27 million Californians
- 750,000 acres of farmland
- 36 Storage Facilities
- 21 Pumping Plants
- 4 Pumping-Generating Plants
- 5 Hydroelectric Plants
- 26 Dams
- 705 miles of Canals and Pipelines
Post-Oroville Spillway Incident Considerations

- Recognition of commonalities between Oroville Spillway and other State Water Project spillways such as:
  - Clay herringbone drains
  - Variable foundation conditions
  - Lack of water stops
- Need for a thorough condition assessment and verification of as-built conditions
- 26 State Water Project dams with a wide range of spillway types, sizes, and frequency of use
Prioritization Considerations

- Hazard/Population at Risk
- Features Common to Oroville Spillways
- Frequency of Use & Purpose
- Known recurring maintenance needs
- Current understanding of spillway condition
- Erosion potential of spillway foundations and unlined spillways

Pyramid Dam Spillways
Phase 1a and 1b

- Seven spillways identified as Phase 1a (high priority) with inspection efforts initiated in 2017
  - Pyramid, Castaic, Cedar Springs, Del Valle, Antelope, Frenchman, and Grizzly Valley
  - Consistent with spillways identified by FERC and the California Division of Safety of Dams

- Balance of spillways incorporated into Phase 1b for inspection efforts in 2018 & 2019
Scope of Phase 1a Inspections & Condition Assessments

- Thorough review of design and construction documentation
- Detailed visual inspections & documentation of spillway conditions
- Plans limited to Non-Destructive methods to expedite inspections and regulatory reviews
- Ground penetrating radar & impact-echo testing
- Drain inspections (where feasible)
- Drone-based imagery
- Review of designs and comparison against modern spillway design “best practices”
- Review of geologic conditions for correlation to observed spillway conditions
- Review of findings in context of typical spillway potential failure modes
Challenges of Phase 1a

• Limitations for Inspection Windows
  – Potential spillway use
  – Nesting birds and bats
• Safety Planning – Rope Access and scaffolding
• Difficult access to underdrains
• Procurement of specialty contractors (rope access, geophysics, drain inspections)
• Uncertainty in geophysics results
Outcomes of Phase 1a

- 2017 Maintenance Actions at six spillways (joint sealing, crack repairs, and concrete spall repairs)
- Development and implementation of a formalized Winter Operations Plan for Pyramid and Castaic Dams
- 2018 Del Valle Stilling Basin Repairs
- Information leveraged to develop the scope of “Phase 2” Invasive Investigations
Phase 2 Spillway Projects

- These invasive investigations commonly include:
  - Removal of backfill to reach underdrains for video inspection and cleaning
  - Coring of spillway inverts to validate or dispel geophysical survey anomalies, concrete thickness, and reinforcing steel conditions
  - Geologic borings to better assess foundation conditions and confirm construction-era assessments
  - Analyses (hydraulic, stability, erodibility)
  - More construction-era surprises!
Anticipated Spillway Inspection and Condition Assessment Outcomes (Industry-wide)

- Enhanced understanding of spillway performance
- Enhanced surveillance and monitoring of spillways, particularly during spillway releases
- Increased frequency, and greater effort and resources applied, to post-spill inspections
- Increased frequency of spillway maintenance actions
- For emergency/auxiliary spillways deemed susceptible to significant and unacceptable damage, large capital improvement projects will be pursued to mitigate risk.
Thank you

Questions?