OROVILLE DAM CITIZENS ADVISORY COMMISSION

Hosted by the California Natural Resources Agency

CALIFORNIA NATURAL RESOURCES AGENCY

ROLL CALL

ITEM 1
WELCOME AND COMMISSION UPDATES

ITEM 2
COMMISSION REPORT UPDATE

Final Report

Oroville Dam
Citizens Advisory Commission Report

CALIFORNIA NATURAL RESOURCES AGENCY

CALIFORNIA DEPARTMENT OF WATER RESOURCES

CALIFORNIA NATURAL RESOURCES AGENCY

We are pleased to submit this first triennial report to the Legislature on the work of the Oroville Dam Citizens Advisory Commission.

The Commission was born of a public safety emergency in February 2017. In record-breaking storms that year, the Dam's main spillway and the emergency spillway suffered significant damage, and approximately 188,000 people downstream were evacuated on an emergency basis. The Dam was never compromised, and the spillways have been repaired and improved over the last five years. However, the emergency and the fear and concerns it raised made plain the critical importance of those managing the Oroville facilities to strengthen communication and information sharing with those who live, work, and recreate in this area.

Since its creation by the Legislature and Governor in 2018, the Commission has established a regularly scheduled forum where people from communities surrounding California's second-largest reservoir are updated on activities and ongoing safety efforts at the reservoir. These meetings allow local officials and residents to ask questions and offer input to the government officials who manage that reservoir and its Dam, and its associated facilities.

Meeting for at least two hours at a time, multiple times a year, the wide spectrum of representatives on the Commission have delved into subjects of keen concern to Oroville area residents: status of efforts by the Department of Water Resources (DWR) to complete improvements after the 2017 spillways incident; efforts to revamp the federal rules that guide flood control operations at Oroville Dam; assessments of downstream risk in major winter storms; and DWR's operations and maintenance practices. The Commission has made site visits, convened technical experts on an array of topics, and provided local residents opportunities to ask frank questions of high-level State decision makers.

As chair and vice chair of the Commission, we are grateful to those who have taken the time to raise concerns and offer input to the Commission. We also appreciate all of those in local, State, and federal government; academia; and the private sector who have shared their expertise. Lake Oroville plays a large role in California's economy and environment, and dam operators balance multiple needs that include flood control, water supply, environmental needs, electricity generation, and recreation. Maintaining safe operations of the Dam and reservoir as all these needs are met is essential. In the wake of the 2017 spillway incident, community questions and concerns regarding safety continue to be voiced. The role of the Commission as a forum to discuss and address these concerns remains vital.

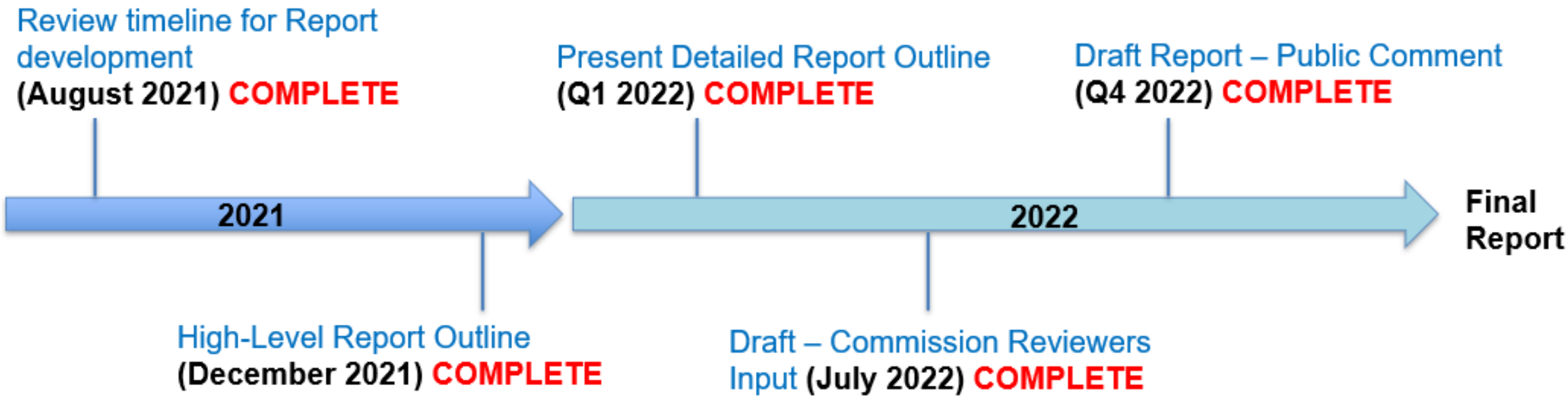
The work of the Commission is ongoing, dynamic, and essential to ensure trust among State agencies and local communities. We are committed to listening to and working to address, as best possible, the questions and concerns of Oroville-area citizens, and we will encourage our successors to do so as well. Together we can continue to foster open dialogue that ensures the safety and effective operation of Lake Oroville.

Sincerely,

California Secretary for Natural Resources, Wade Crowfoot, Chair

California State Senator, Jim Nielsen, Vice Chair

Commission Report Development Timeline



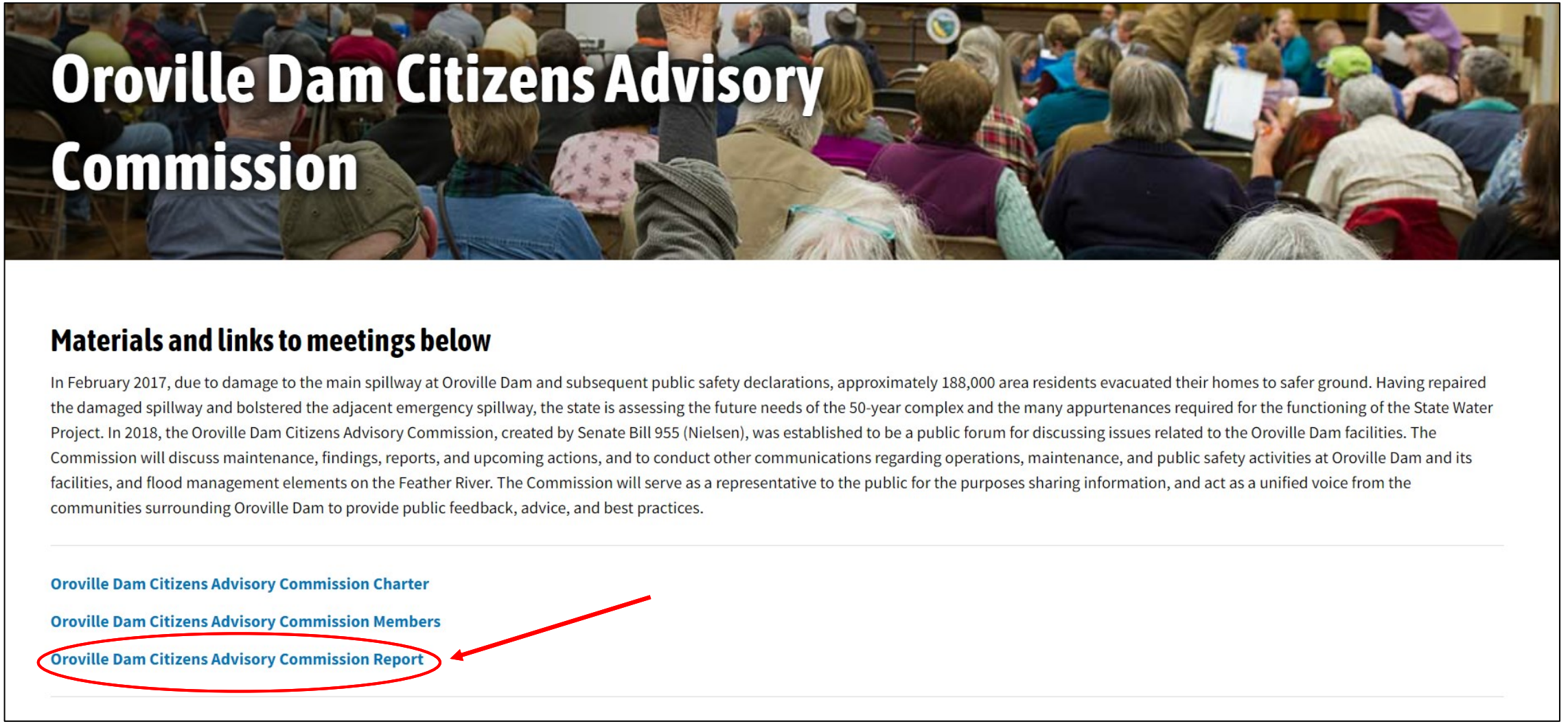
Report and Content Mandated by SB 955

The commission must publish a report once every three years that provides the following:

1. An overview of ongoing maintenance and improvements made at the dam and its site.
2. A register of communications received from the department and other parties to the Commission.
3. Notice of upcoming plans made by the department for the dam and its site.
4. An overview of flood management projects on the Feather River affecting public safety and flood risk reduction.

Commission Report

- Click “Oroville Dam Citizens Advisory Commission Report” on the main page to be taken to the Report landing page.

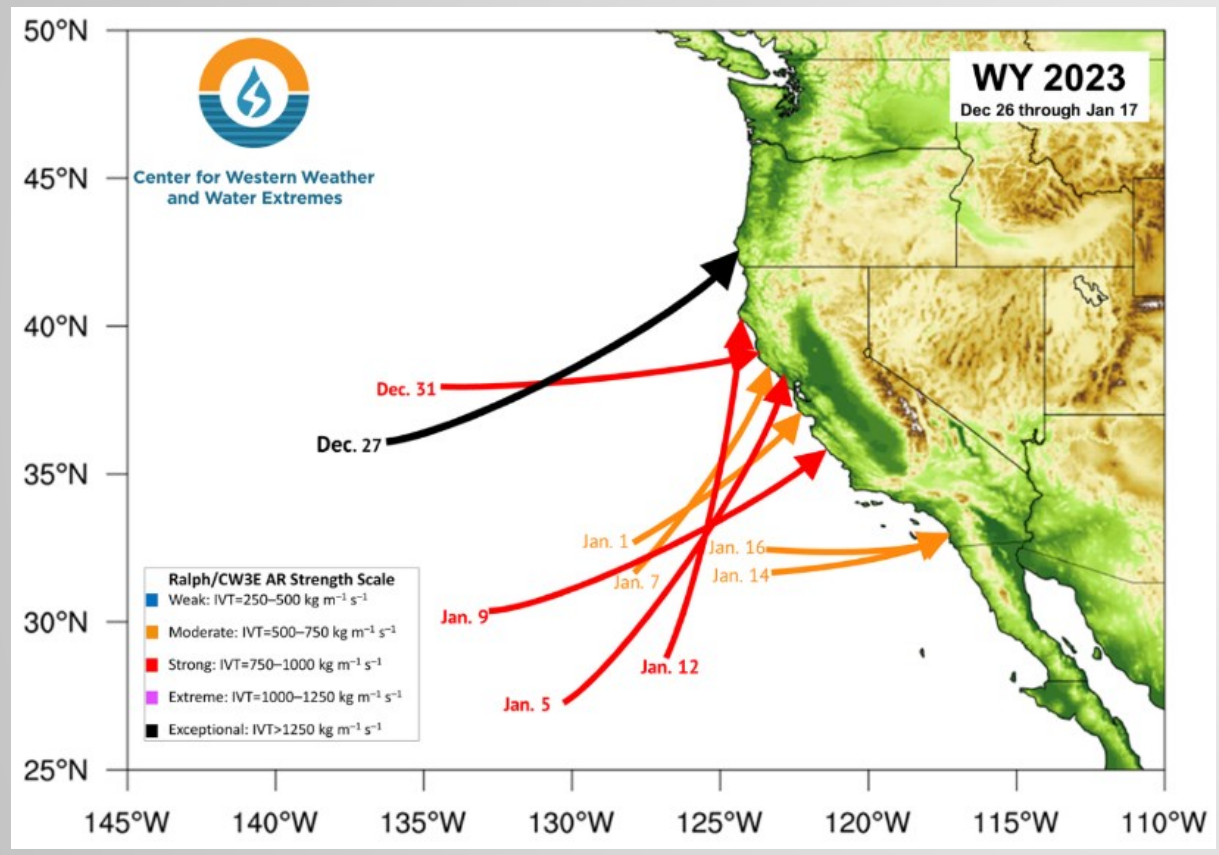


Questions?

ITEM 3
JANUARY STORMS UPDATE

Winter Storms

Dec 26, 2022 - Jan 17, 2023



- 9 Atmospheric Rivers in 3 weeks
- 1 Exceptional
- 4 Strong
- 4 Moderate

- Only 3 strong ARs in WY2020 and WY 2021 combined

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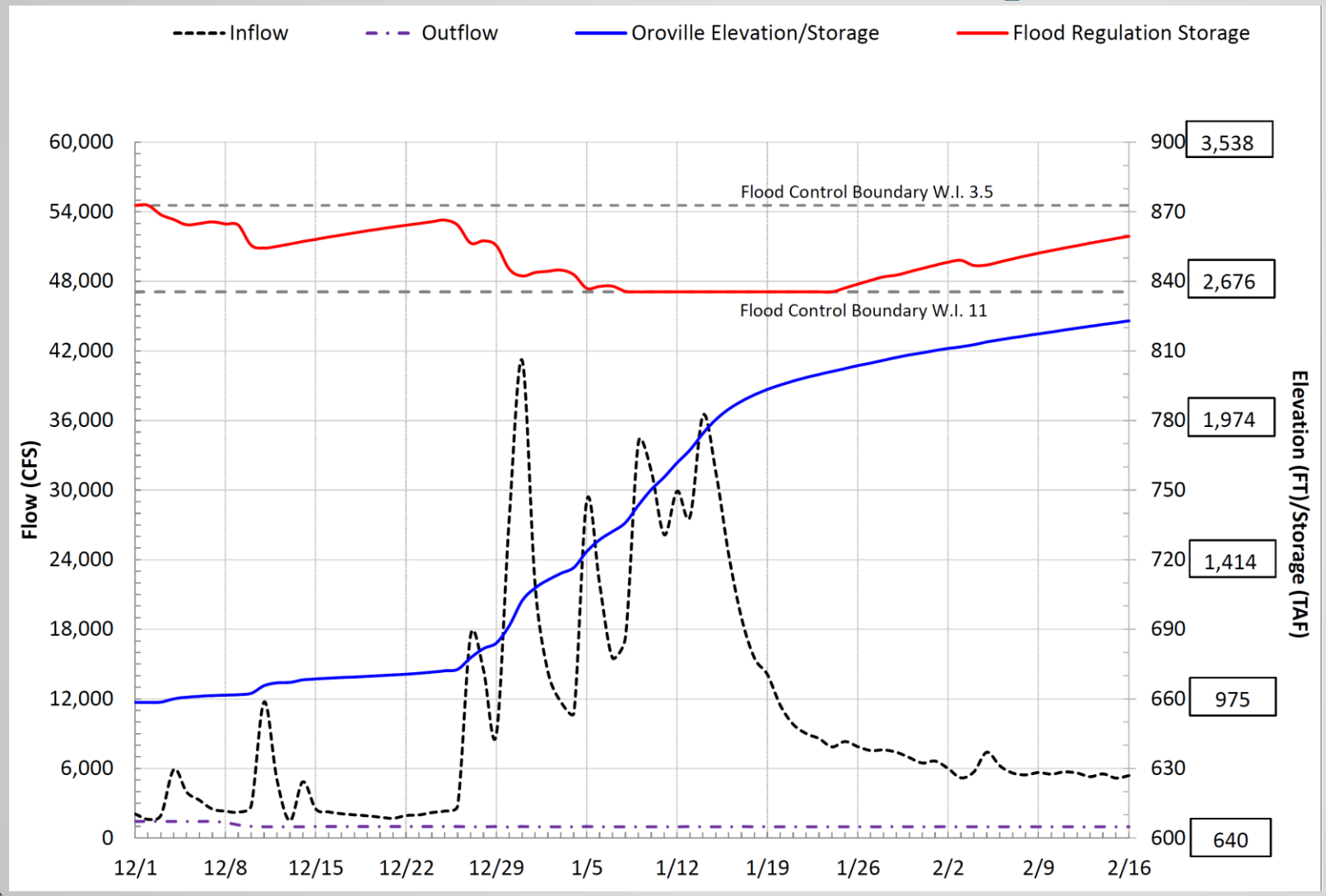
Oroville Facilities Update



- Total Feather River releases remain at 950 cfs.
- As we continue to assess current conditions, changes in releases may occur and will be scheduled to the Feather River accordingly.

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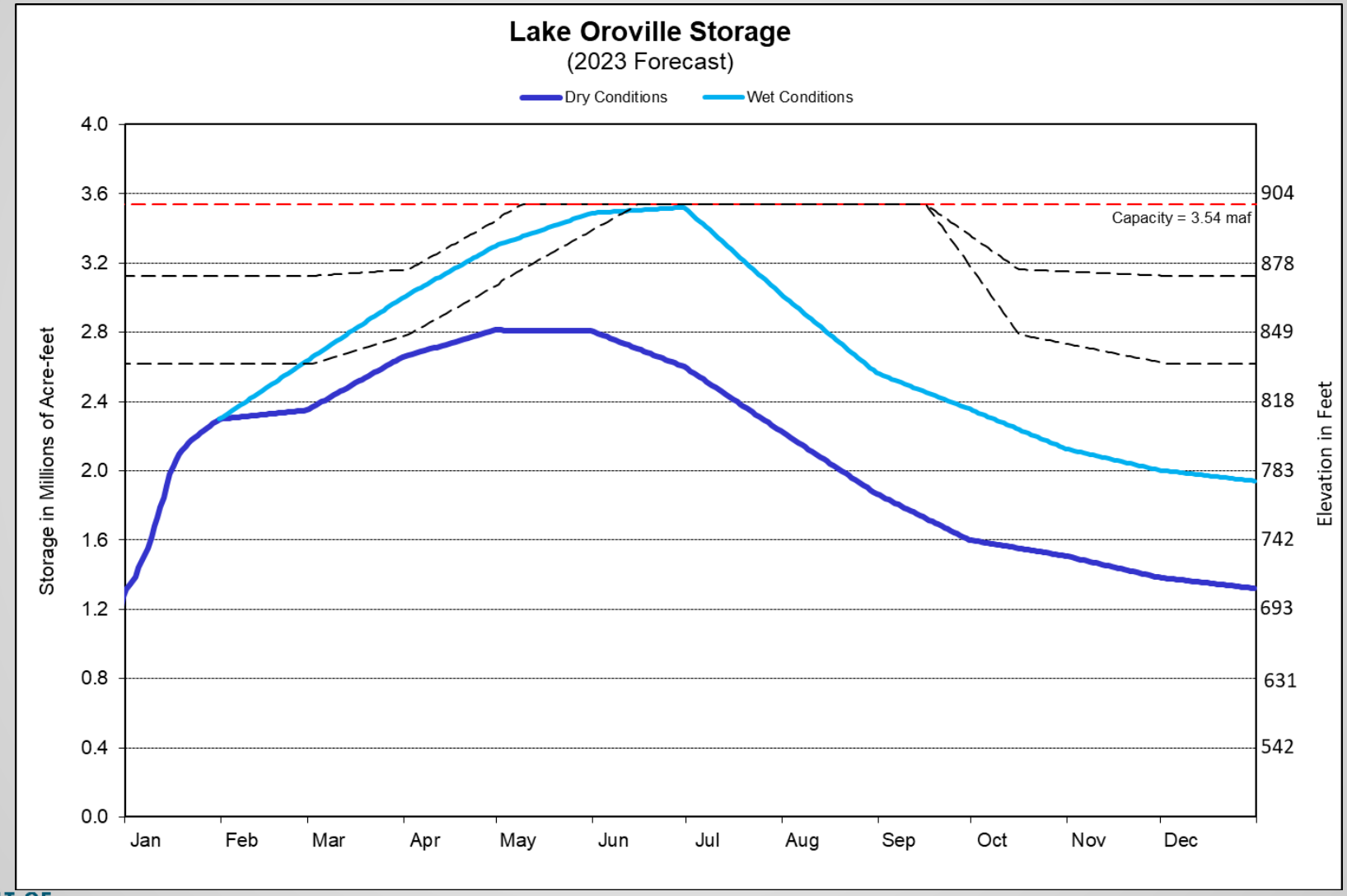
Oroville Facilities Update



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Butte County
Office of Emergency Management

Deputy CAO-OEM, Josh Jimerfield
jjimerfield@buttecounty.net
530.552.3333 - O
530.624.4729 - C

Butte County OEM Response to January Winter Storms

- The County OEM response begins locally and grows based on need
  - Weather forecasts and anticipated impacts.
    - Localized flooding, trees, potential debris flows from recent fires.
  - For the Winter Storms – Public Works, Law Enforcement, and Fire are the boots on the ground that help identify potential impacts.
  - As impacts grow the County initiates an Operational Area Coordination Call.
    - Brief outs from the County – OEM, PW, PH, and others as appropriate
    - Jurisdictional updates
    - State update
    - Reimbursement reminders
    - Unmet needs to be elevated

Butte County OEM Response to January Winter Storms
Concurrent Actions within OEM

- Begin monitoring California Data Exchange Center info
- Outreach call by SO to DWR field Office
- Review of Oroville Dam Emergency Action Plan
- Coordination call with DWR Flood Ops Center and U.S. Army Corps Water Management Branch
- Initiation of disaster proclamation process
- Outreach and support to community - Sand Bags/Sand, PSAs on flooded roads, safety info, etc
- Coordination with State on possible CDAA or FEMA claims

2022-2023 Winter Storms

COUNTY OF YUBA – OFFICE OF EMERGENCY SERVICES

OSCAR MARIN, EMERGENCY OPERATIONS MANAGER

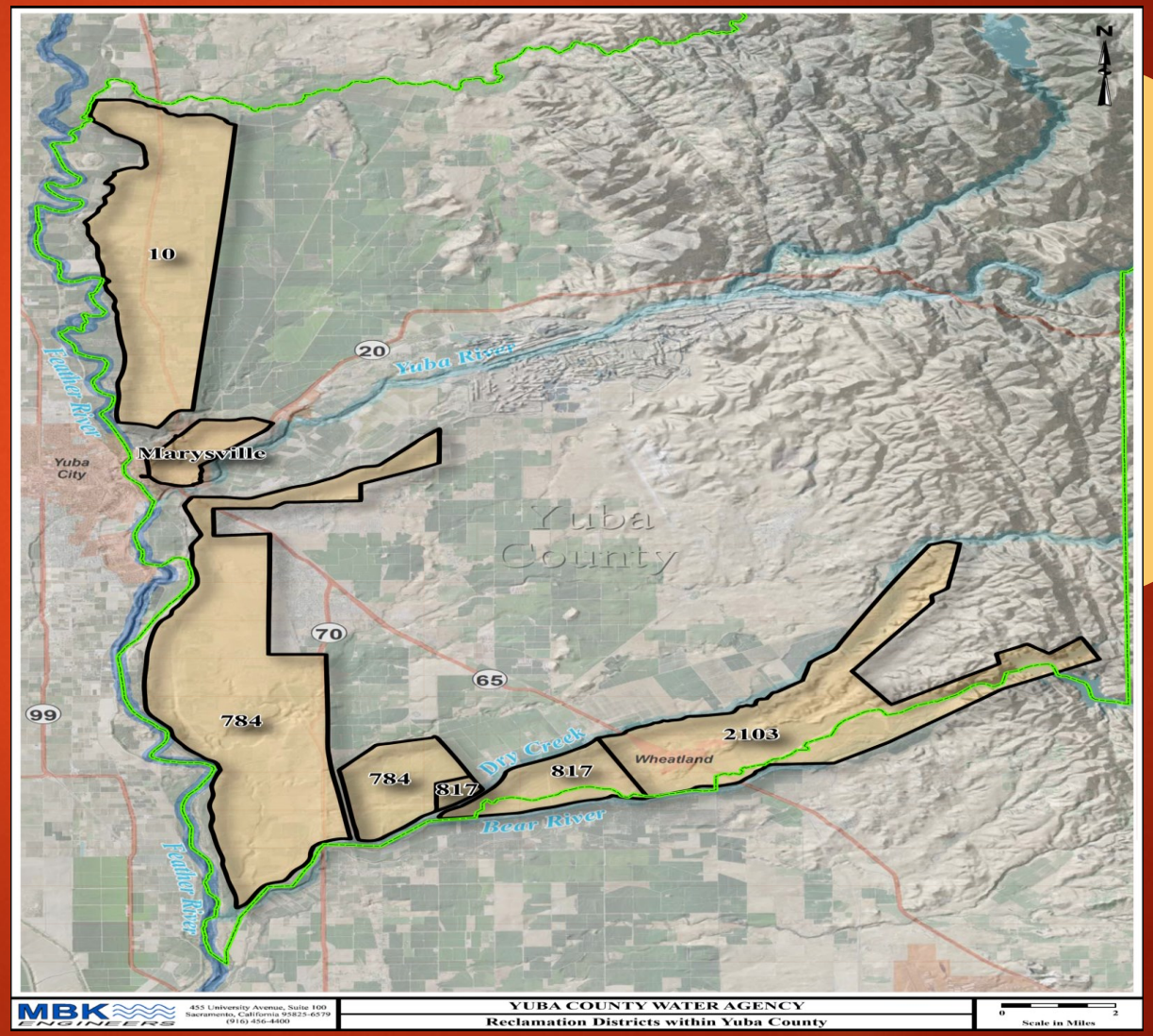
OMARIN@CO.YUBA.CA.US

OFFICE: (530) 749-7521

CELL: (530) 845-3029

New Year's Eve Atmospheric Rivers

- Communications:
  - Reclamation Districts 784 – Yuba / Bear River Levee System
  - Reclamation District 817 – Bear River Levee System & Dry Creek
  - Reclamation District 2103 – Bear River Levee System & Dry Creek
  - Yuba Water Agency – Bullard's Dam
  - All Public Safety Agencies
  - PG&E & Cal - OES
  - County Public Works & other dept.
  - Elected Officials



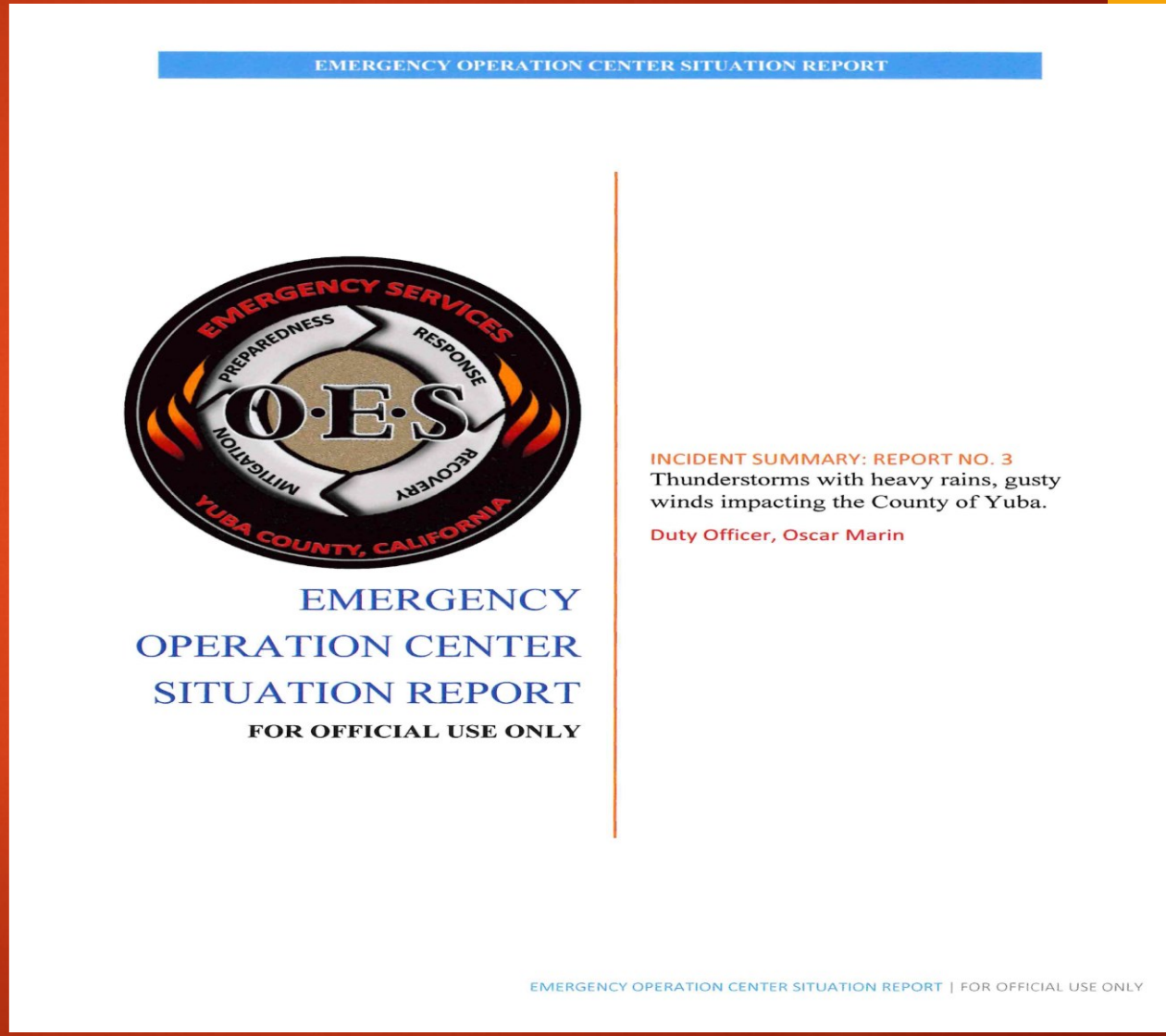
New Year's Eve Winter Storms

What was monitored?

- River Levels & levee system
- Hourly weather forecasts
- Surrounding Counties

How was information gathered?

Who was included in the situational reports/briefings.

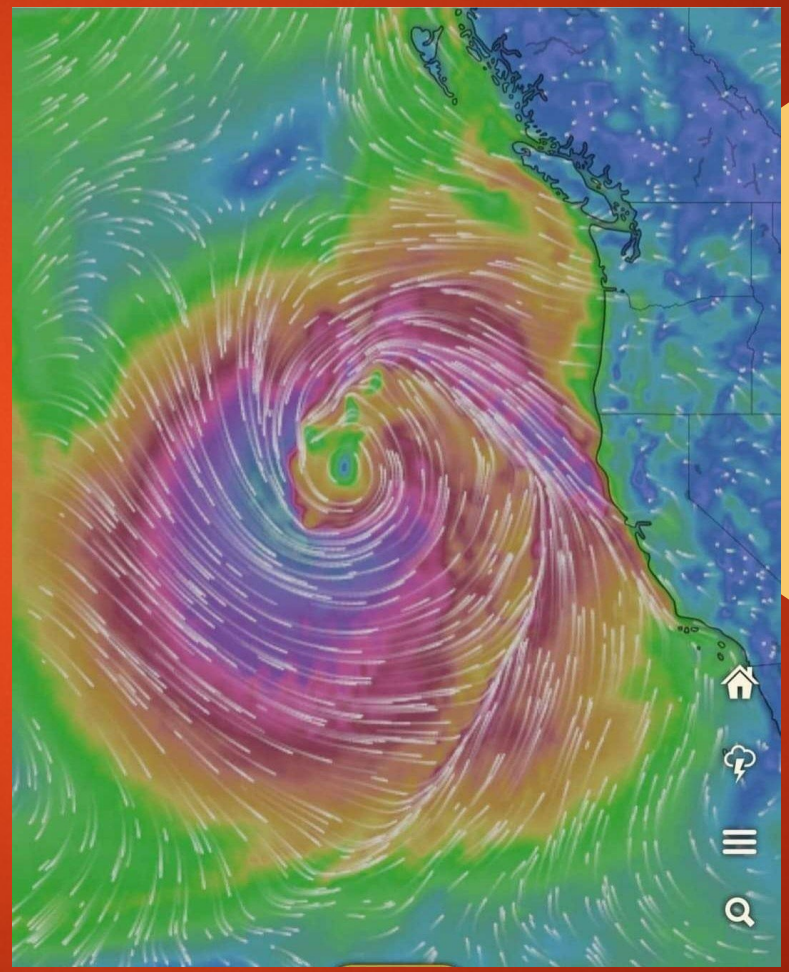


2022-2023 Winter Storms

Actions:

- **Situational Reports x2 a day**
- **Community Outreach** – Sandbags, sand; Public Safety announcements, flooded roads/down trees, power outages

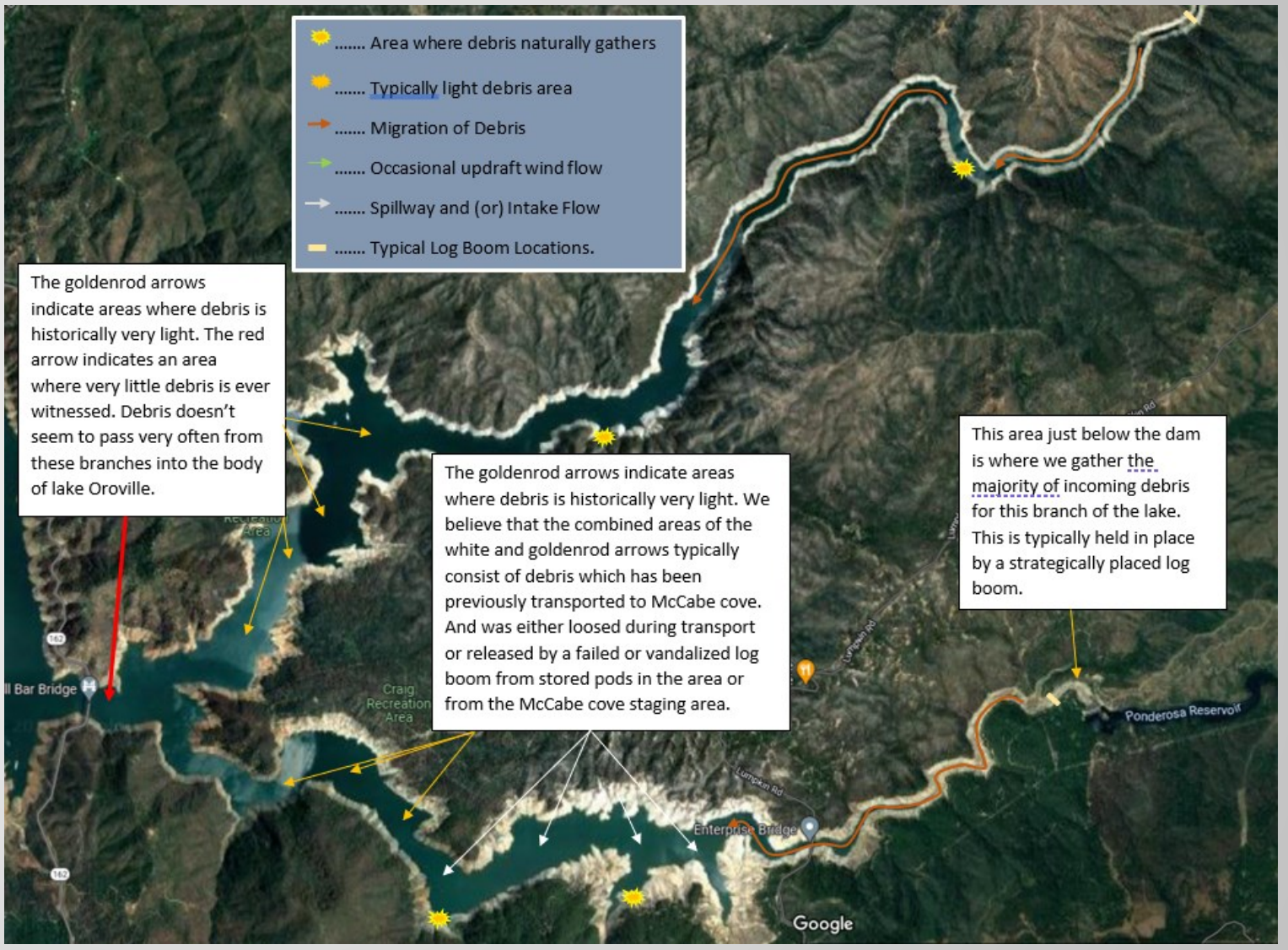
Emergency Operations Center – Activation to a "Duty Officer Status".



ITEM 4
RESERVOIR DEBRIS MAINTENANCE

Debris Management on Lake Oroville

- Hazard to radial gate operations and recreation
- Planned as an Annual Civil Maintenance Activity – dedicated resources
- Leverage past experiences and observations
- Crews trap debris within the arms of the reservoir with buoy lines
- Move as “pods” across the lake.
- Dispose of debris once “beached” in the summer and fall



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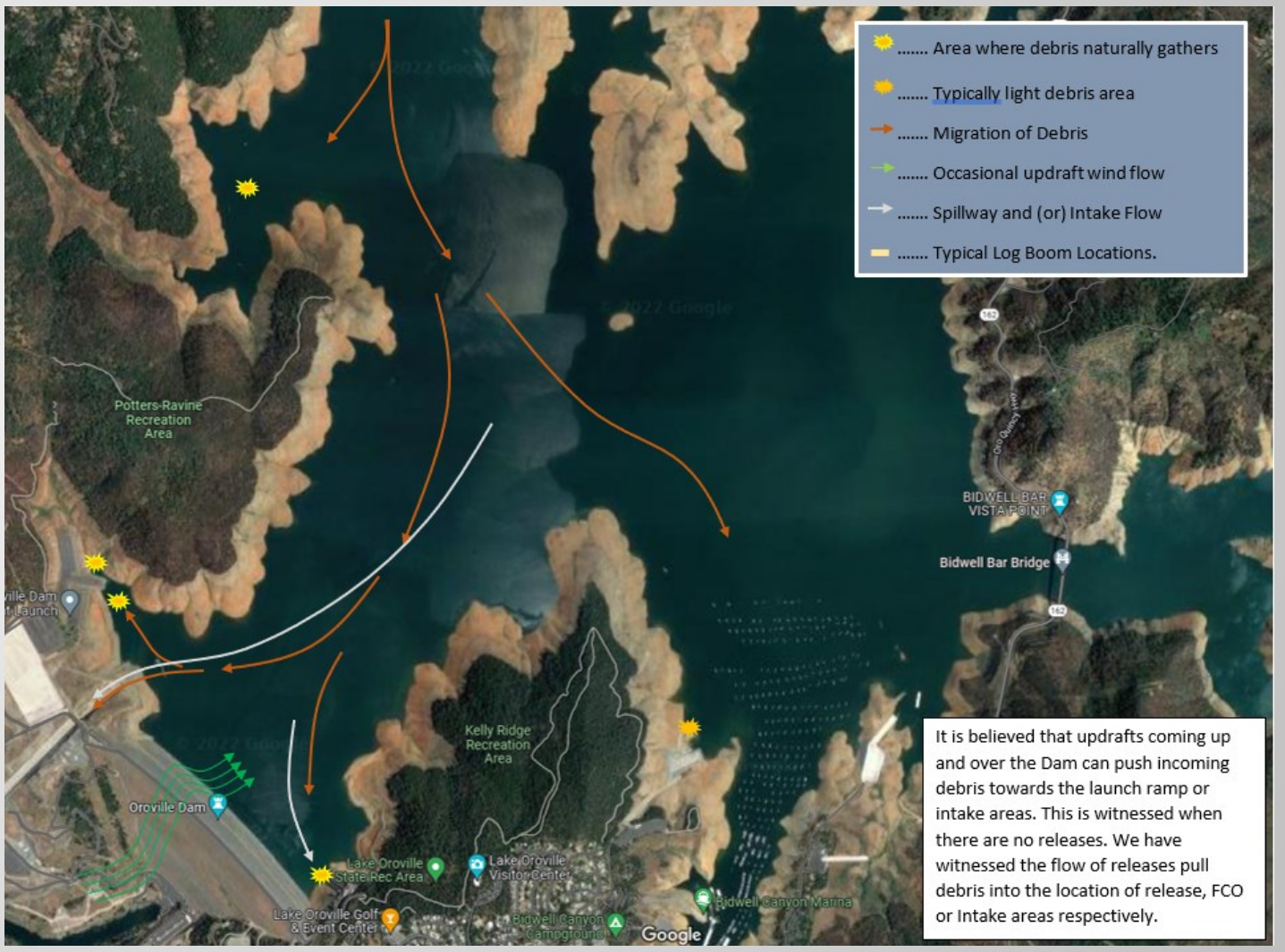
Debris Management on Lake Oroville

- Areas of known debris accumulation
- Driven by magnitude and duration of inflows
- 2017 inflows led to greater than normal debris loads that were successfully managed with Field Division resources



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Burned Watershed Impacts

- Inflows peaked around 52,000 cfs on December 31, 2022
- To date, OFD crews report normal levels of woody debris, with observations of burnt debris
- What action is DWR taking?
  - On-Call Contract for Additional Vessel for Pod movements
  - Increased surveillance and documentation of woody debris on the lake
  - Identification of resources from other Field Divisions for on-call support
  - Continue to quantify debris at the end of the season
  - Woody Debris Modeling Pilot Study
    - What might we expect?

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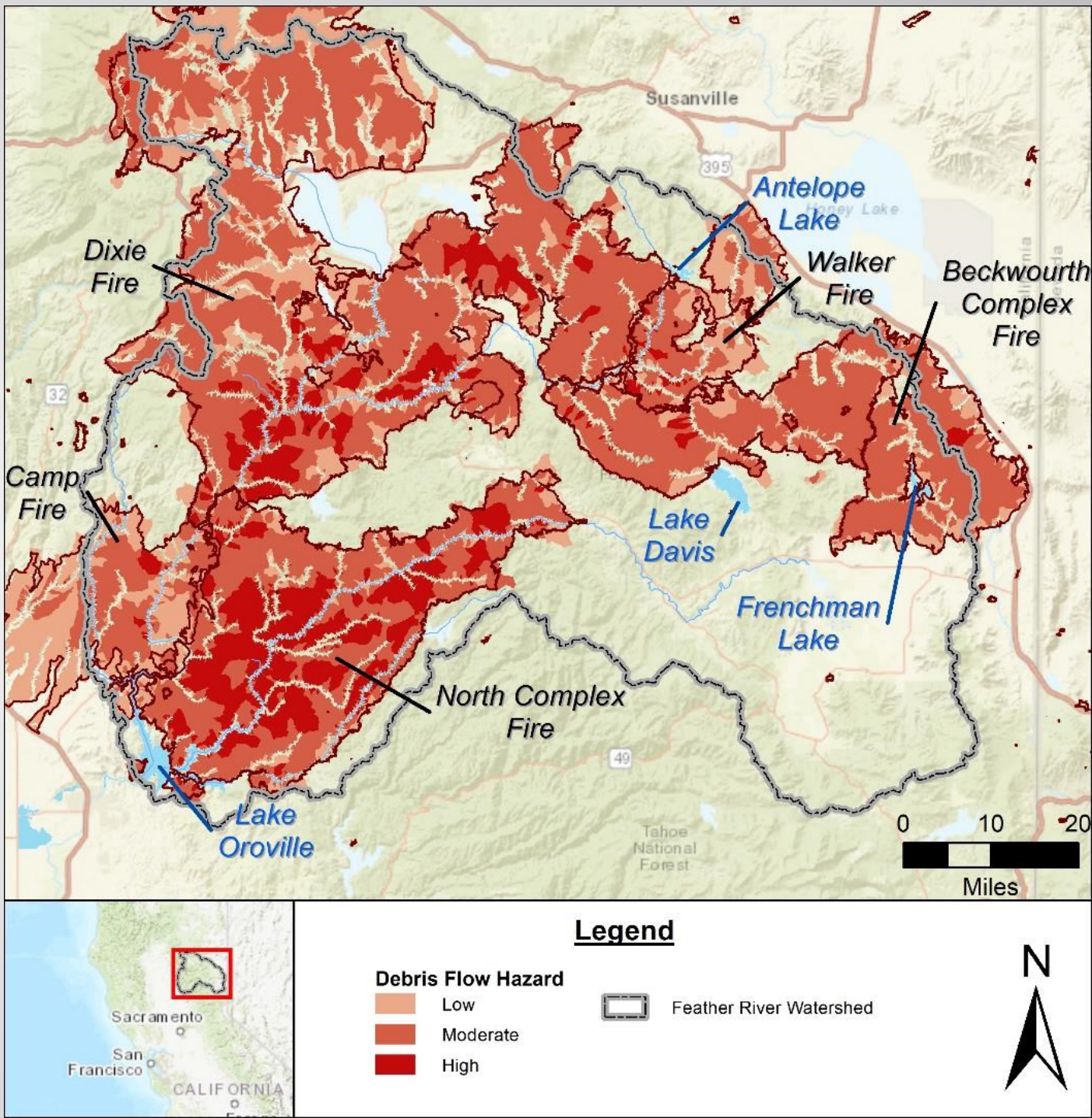
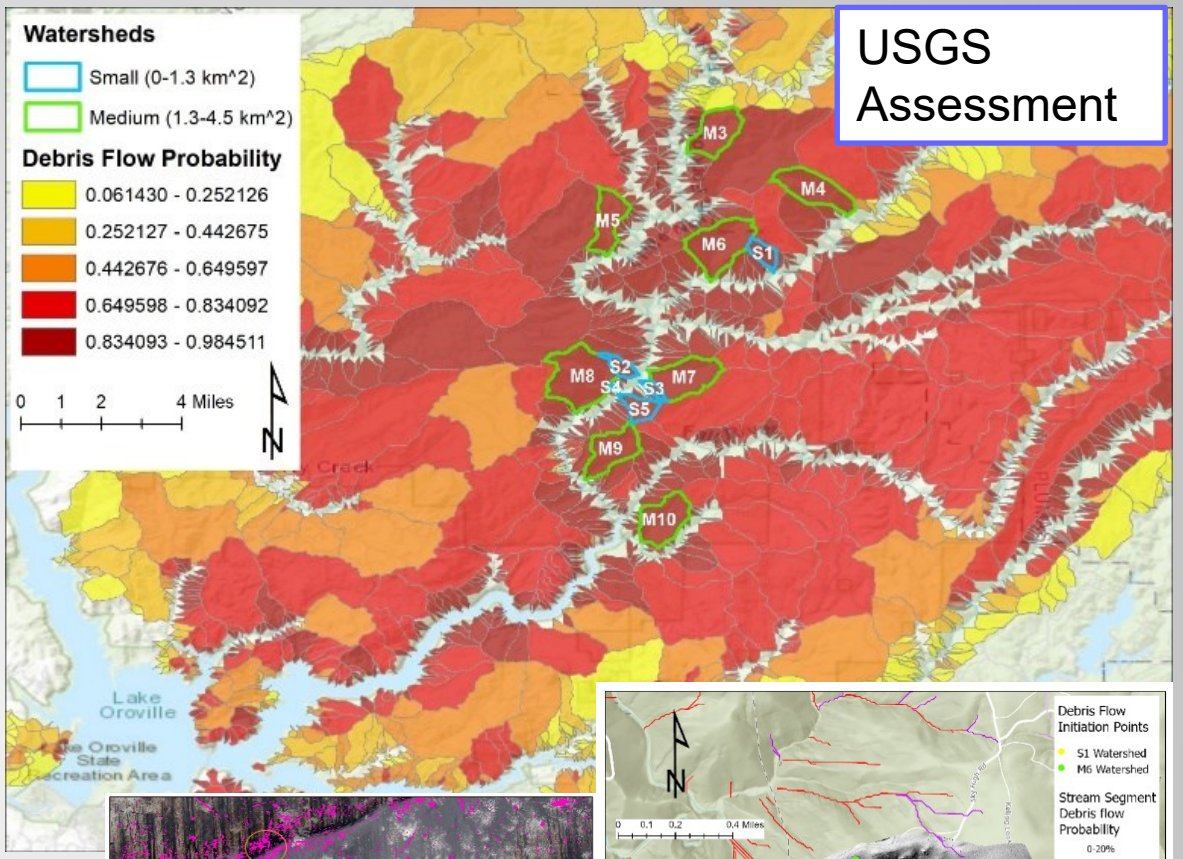
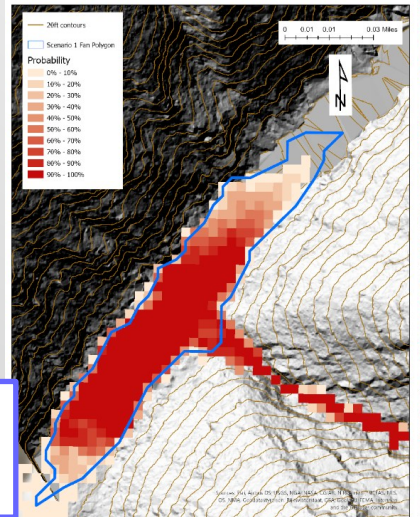


Woody Debris Modeling Pilot Study

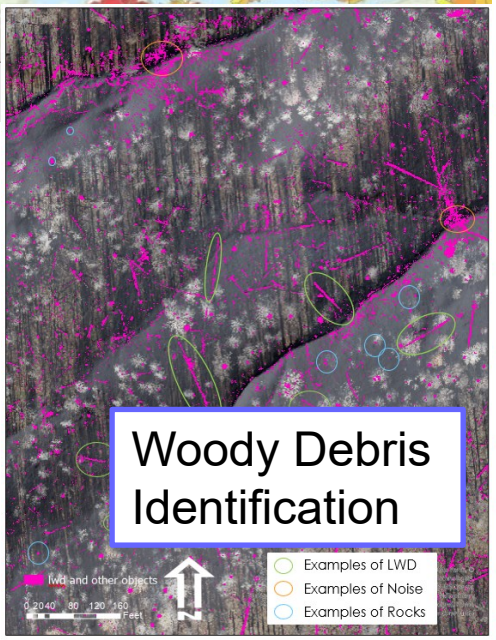
- Scope tailored to a small portion of the Lake Oroville Watershed
  - Debris flows are primary mode of mobilization
  - 8 Medium and 5 Small “sub-watersheds” in the 2020 North Complex Fire footprint, Middle Fork of Feather River
  - Watersheds selected based on high debris flow probability from USGS Landslide Hazard Assessment
- Utilized 2021 LiDAR to identify Large Woody Debris
  - Defined as > 1 meter length and > 10 cm diameter
- Utilized consultant’s proprietary debris flow prediction software to model debris flow locations and run-out
- Overlaid debris flow pathways with debris to identify “mobilized” debris



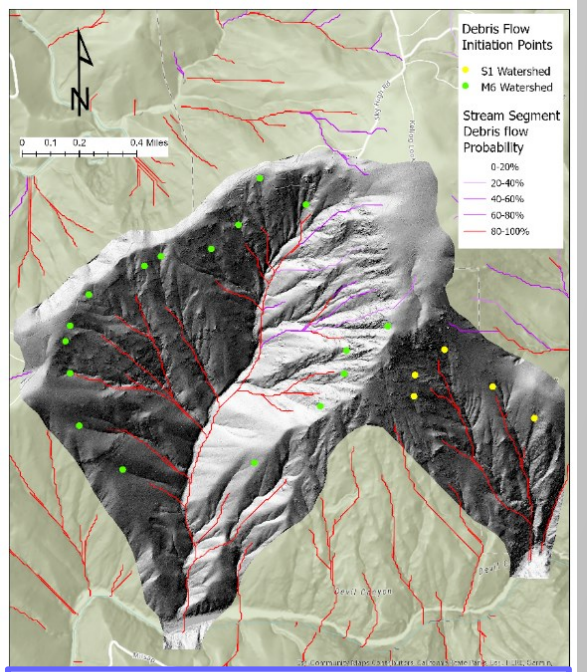
USGS Assessment



Debris Flow Run-out



Woody Debris Identification



Debris Flow Predictions

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- **Transport modeling was performed for 1-, 2-, 5-, 25-, 50-, 100-, and 500-year flows in the Middle Fork of the Feather River.**

Figure 37. Flow path volume raster for the 50-year event.

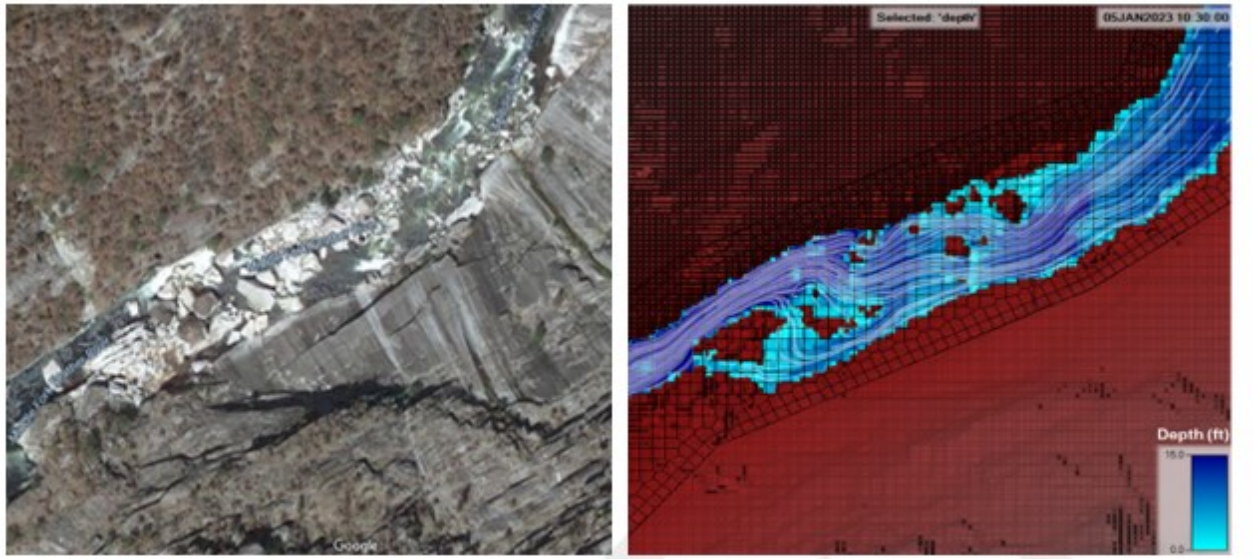

Figure 34. An example of flood depth overlaid with the velocity streamlines from the 2D HEC-RAS model at a rocky section of the MF Feather River for the 5-year event.

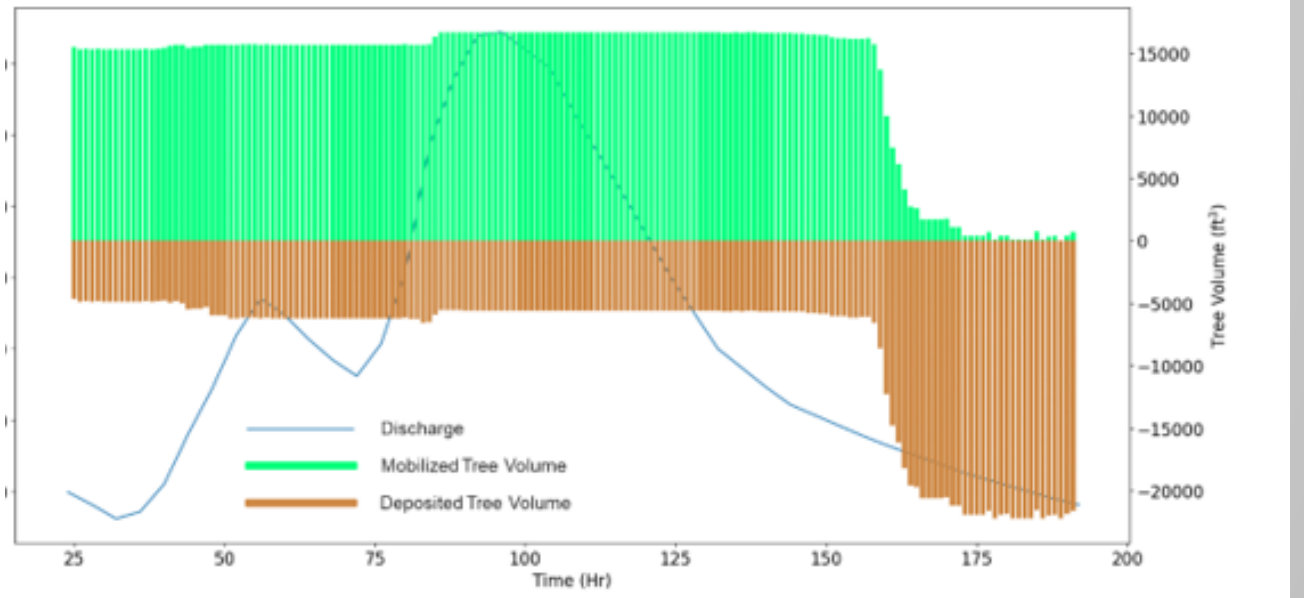

Figure 36. Temporal LWD transport dynamics against the hydrograph for the 50-year event.

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- **Transport ratios were developed for each of the 13 sub-watersheds as a function of hydrologic event return period.**
  - **Transport Ratio increases with increasing return period (i.e. larger flows transport more debris)**
  - **Volumetric estimates of debris making it to Lake Oroville were then calculated for the 13 sub-watersheds**

  EXTRAPOLATION!

  The 13 sub-watersheds cover 18 square-miles, but the entire burned watershed area is 480 square-miles.
- **An Extrapolation was made to provide a rough estimate for all the burned watersheds**

Return Period Event (years)	Extrapolated Large Wood Debris Volume Estimate for all burned watersheds (cubic feet)
1	9,800 +/-
5	805,000 +/-
25	1,430,000 +/-
60	1,544,000 +/-
100	1,672,000 +/-
500	1,888,000 +/-

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Comparison to 2017 Experience (Reality Check)

- Roughly 17 acres of debris captured by June 2017
- Assuming 4 feet thick, and “packing ratio” of 0.25 yields 740,000 cubic feet.
- The 2017 inflows were about a 20-year return period event.
- The watershed was not yet burned...!
- The Woody Debris Flow modeling predicts about 1,500,000+/- cubic feet of debris (roughly double) for the burned watershed condition.
- Reports for other burned watersheds have reported a 50% or greater increase in debris.
- Resourcing Perspective: We may need 2X the resources on the lake....but should not expect to have to deploy 10X the resources.

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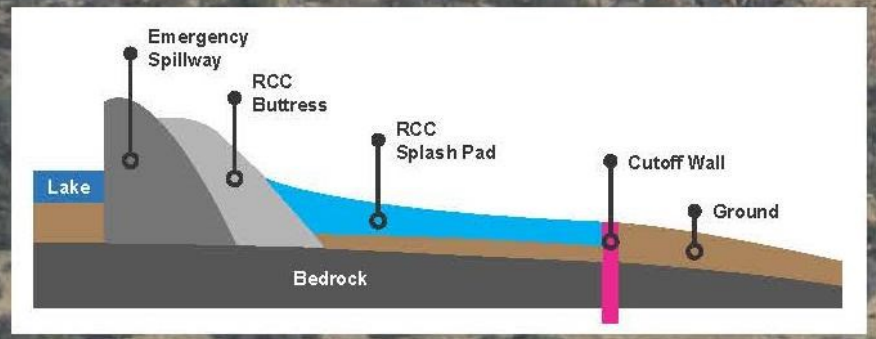
ITEM 4
EMERGENCY SPILLWAY STUDIES

2017-2019 Spillway Recovery Improvements

Roller-Compacted Concrete Splashpad

Roller-Compacted Concrete Buttress

Emergency Spillway



Underground Cut-off Wall (Secant pile wall) 1,450 ft long 35 - 65 ft deep

"Determine the safe capacity of the emergency spillway and the spillway adequacy of Oroville Dam" *FERC, July 14, 2022*

What does it take?

- Define the Probable Maximum Flood (PMF),
- Verify the capacity of the Flood Control Outlet (gated spillway),
- Verify the capacity of the Emergency Spillway,
- Stability of structures under the flood loading,
- Evaluate erosion/scour potential at Emergency Spillway and potential for headcutting

Photo by K. Grow, DWR Public Affairs Office, June 2019

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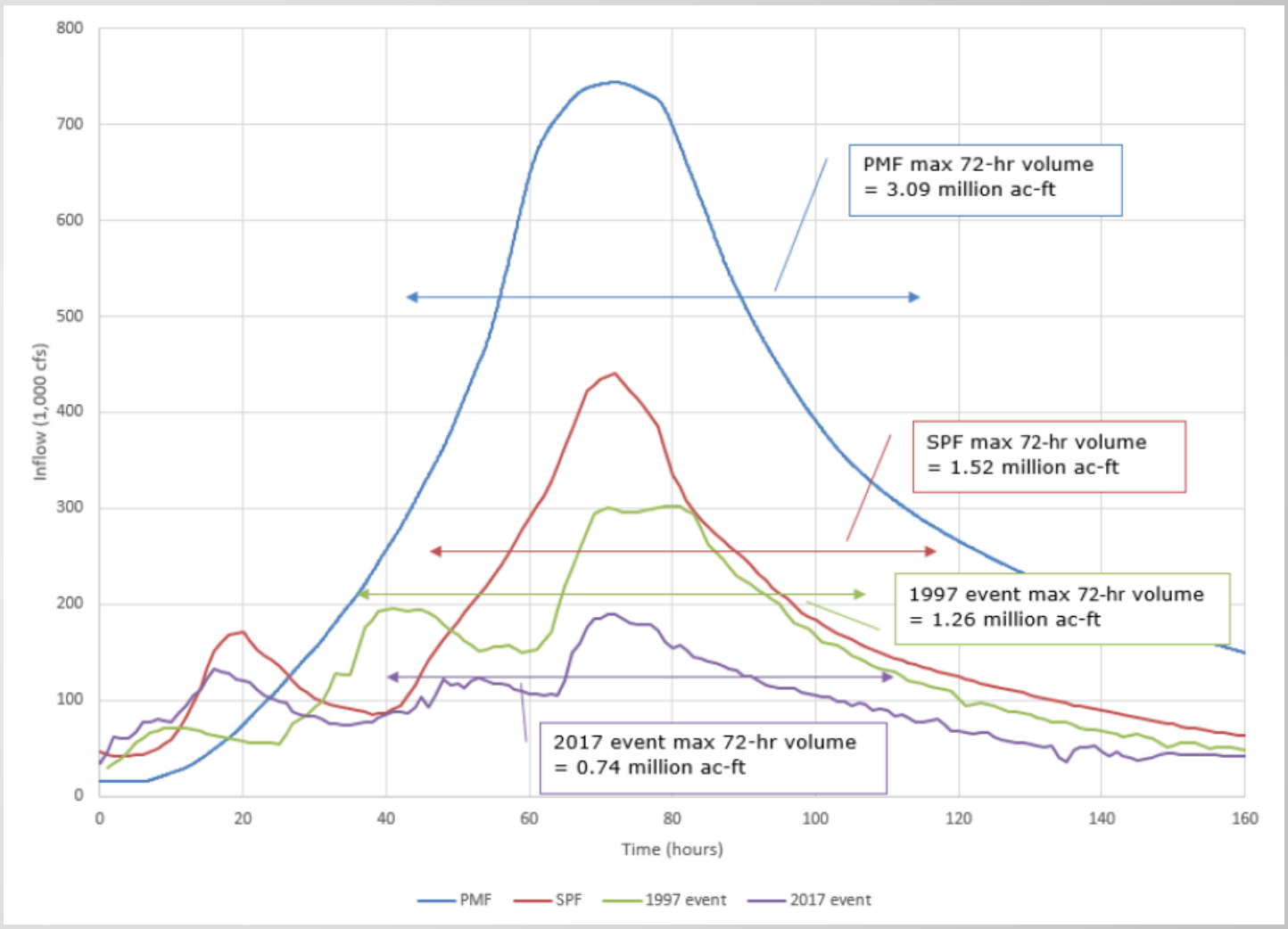
Define the Probable Maximum Flood (PMF) ☑

- Submitted to FERC & DSOD in December 2017
  - Peak Water Surface Elevation = 919.1 feet (NGVD 1929)
  - Dam Crest Elevation is 922 feet...so 2.9 feet of freeboard.
  - PMF – 21,000 +/- year exceedance interval event; <u>used for dam safety</u>
- Standard Project Flood peak inflow = 440,000 cfs; peak outflow = 150,000 cfs; 200+/- year exceedance interval event; <u>used for flood management</u>
- FERC and DSOD comments addressed in 2019 and 2020, with the exception of the Emergency Spillway's performance for flows > 100,000 cfs.



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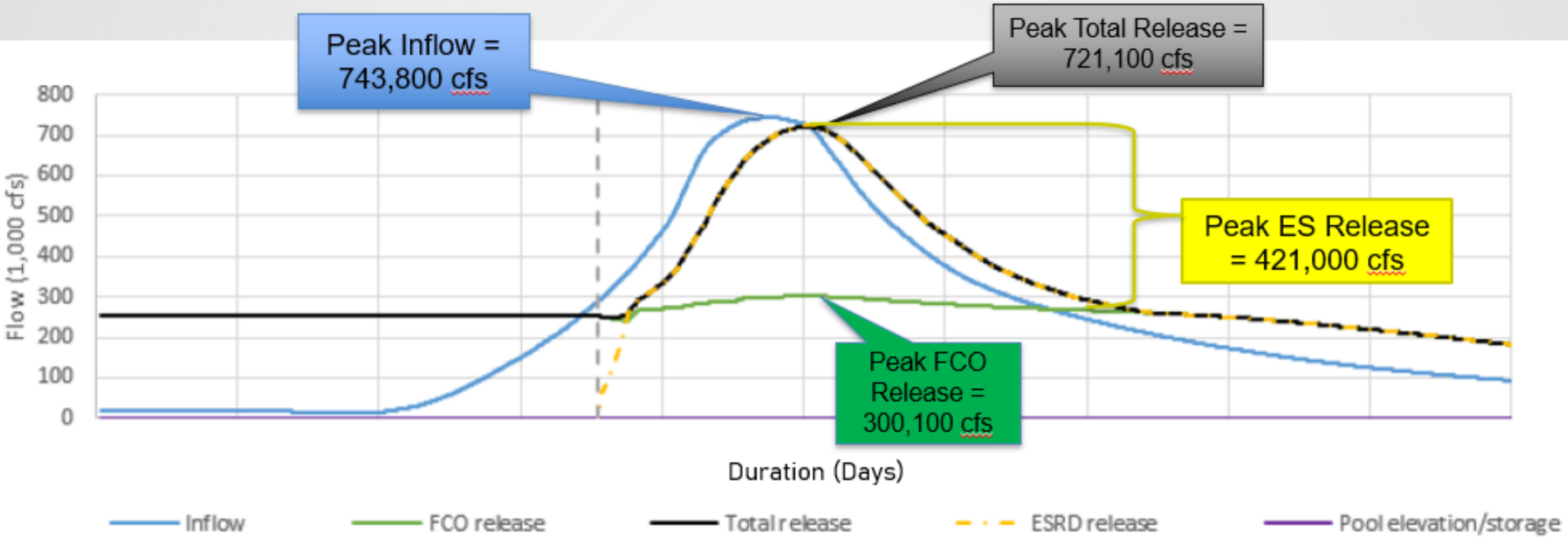
Probable Maximum Flood - Extreme Hydrologic Event

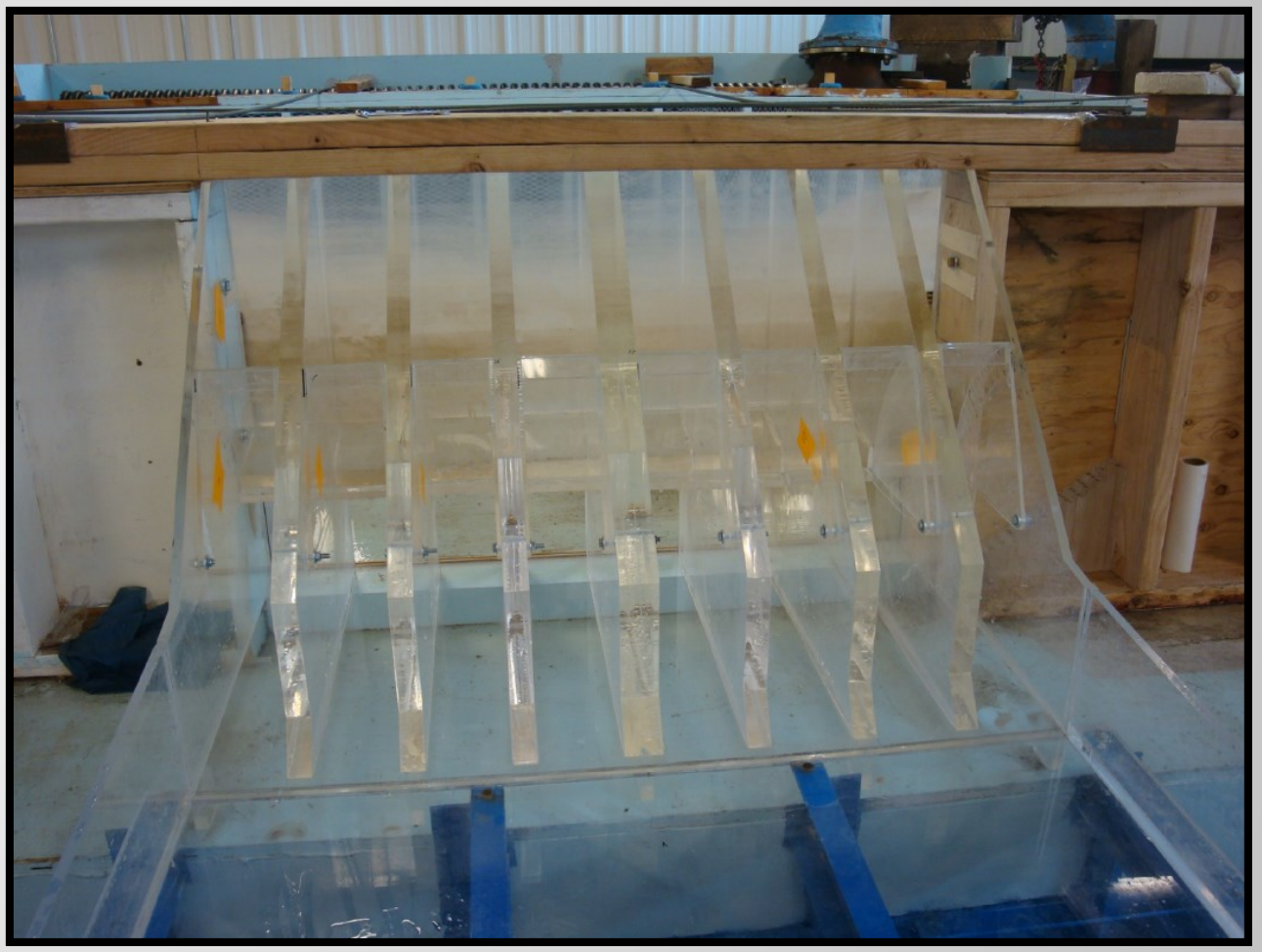
- Rising Limb, Peak, Falling Limb to Inflow & Outflow
- Modeling of hydrograph rather than constant flow.



Verify the Capacity of the Flood Control Outlet Headworks ☑

- ✓Physical modeling performed in 2017-2018
- ✓Agreed with Computational modeling
- ✓Consistent with existing (original) rating curves

No further work warranted



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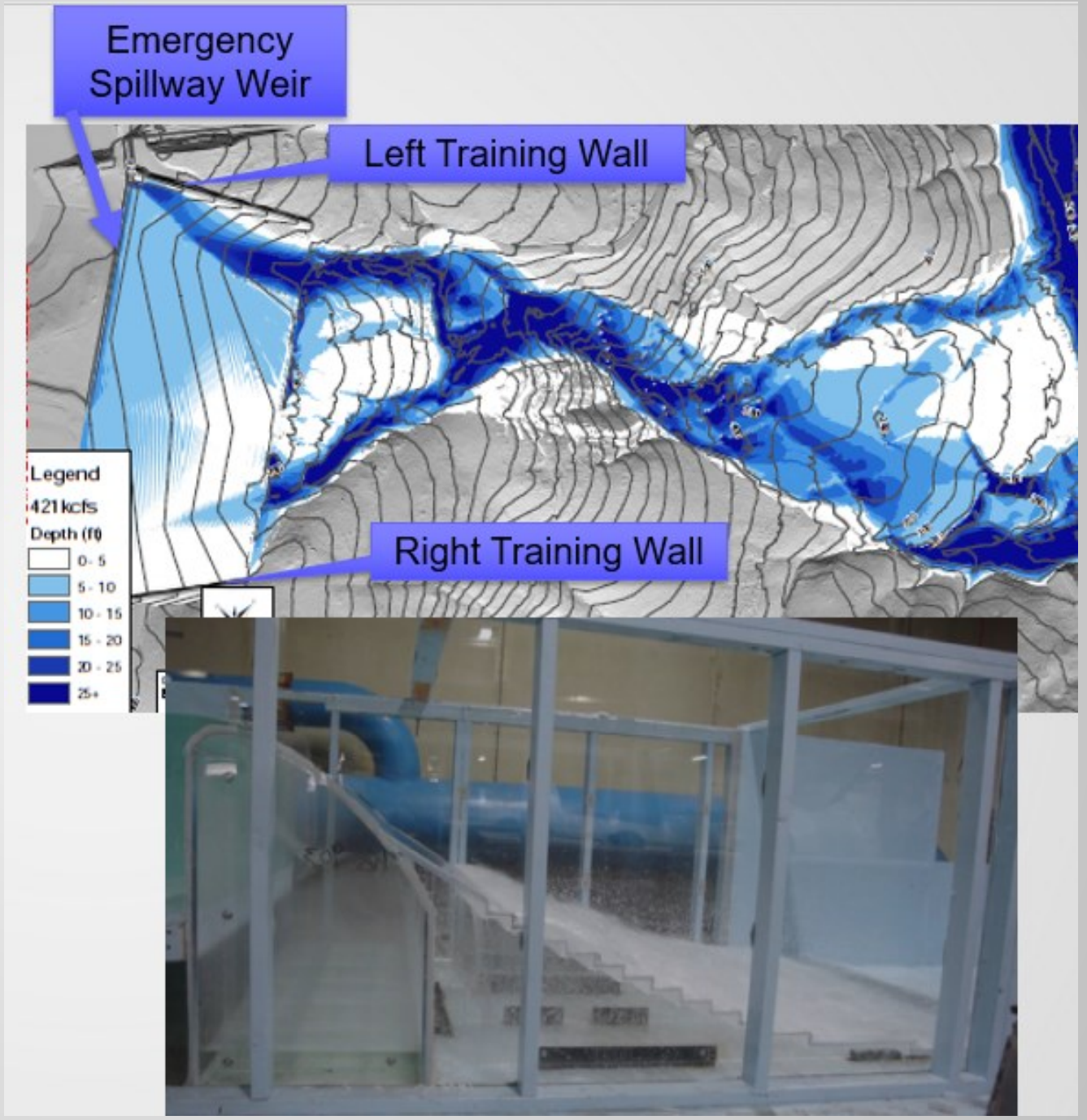
Confirm Emergency Spillway Capacity

- ✓Confirmed that the Roller Compacted Concrete buttress does not reduce the emergency spillway capacity.
  - Demonstrated ES will pass 350,000 cfs with the old PMF elevation of 917 feet.
  - Confirmed Roller Compacted Concrete apron can withstand expected velocities for the old PMF (350,000 cfs)
- ✓Confirmed the parking lot does not impede flows for the 2017 PMF (421,000 cfs over the ES).
- ✓Confirmed Left and Right Training Walls (berms) contain flows

Need to update two of these analyses for the 2017 PMF (421,000 cfs over the Emergency Spillway)



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Confirm Emergency Spillway Stability – Apron & Monoliths ☑

- ✓ Confirmed structural integrity of the emergency spillway apron under extreme loading conditions
- ✓ Updated stability analyses for Emergency Spillway monoliths considering the RCC buttress and apron - Adequate factors of safety demonstrated.
- ✓ Confirmed factors of safety for sliding of the Roller Compacted Concrete apron

No further work warranted

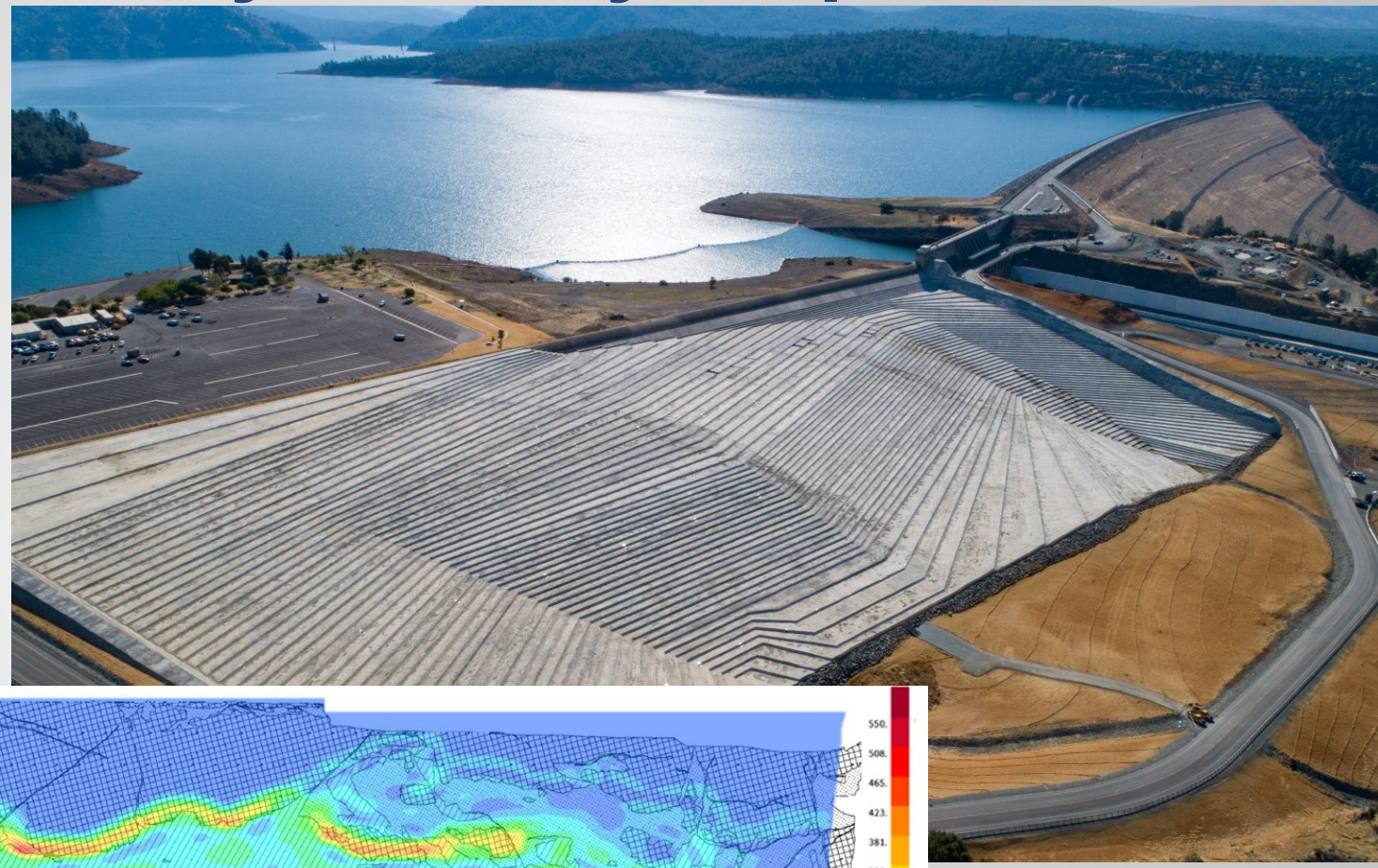

Photo by K. Grow, DWR Public Affairs Office, 2020

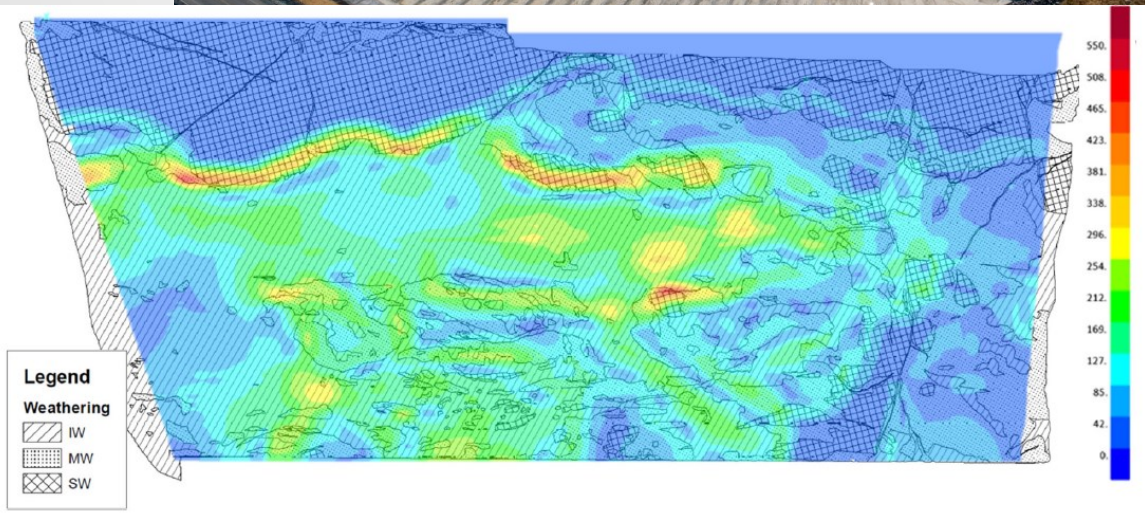

Figure 21 – von Mises Stress (ksi) due to Self-Weight overlain on Revised RCC Apron Geologic Mapping (DWR, 2020a). Overlay Approximate.

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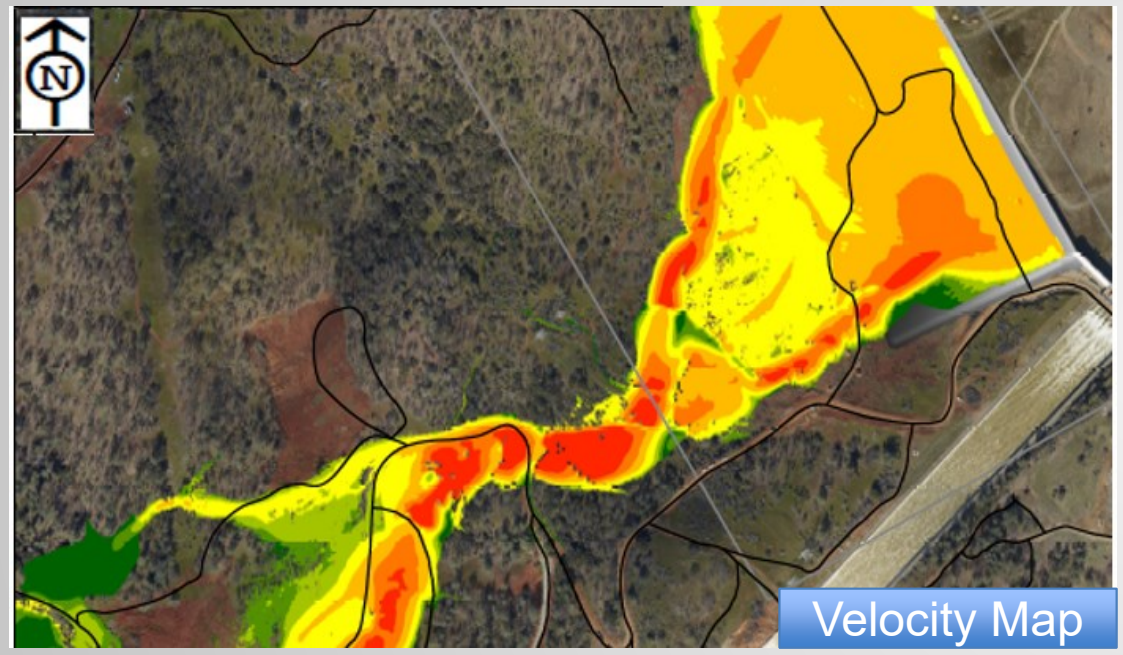
Emergency Spillway – Erosion and Head-Cutting

- Analyses considering 100,000 cfs indicate some scour at and downstream of the secant pile wall, but head-cutting upstream 700 feet to the monoliths unlikely.



Benefits of Quantitative Risk Analysis

- Understand and refine risk associated with Emergency Spillway potential failure modes
- Align with FERC expectations/approach
- Compare with other risks within the SWP

Proposed Further Study

By September 1, 2023, DWR will submit a Work Plan that is anticipated to include:

1) Evaluation of the need for any geologic exploration to address any data gaps, in particular to assess the potential for rock wedge failures in proximity to the secant pile wall. Update 3D Geologic Model

2) Describe the planned erodibility analyses and rock wedge failure analyses. The time rate of scour and flood hydrographs (rather than constant flows) will be considered.

3) Proposed Issue-Specific Quantitative Risk Analysis (QRA) workshop focused on the potential for erosion and head-cutting at the ES. The QRA will leverage the knowledge gained from Tasks 1 and 2.

Considering the time required to receive regulatory approvals for any subsurface exploration and the scheduling of key resources for a QRA, the Work Plan will include a multi-year schedule.

Thank you.

Questions?

Photo by K. Grow, DWR Public Affairs Office, April 7, 2019, 25,000 cfs release

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ITEM 5
PUBLIC COMMENT

The Oroville Dam Citizens Advisory Commission will now take public comment.

We appreciate your input.

ITEM 6
ADJOURN

Thank you all for joining us today, our next Oroville Dam Citizens Advisory Commission meeting will be held virtually on June 30, 2023.