https://www.youtube.com/embed/T5zumuQIMV0

Oroville Spillway Incident

February 7th – February 22nd, 2017

Kevin Lawson

Incident Commander

CAL FIRE Incident Management Team 3

Commonly used Terminology

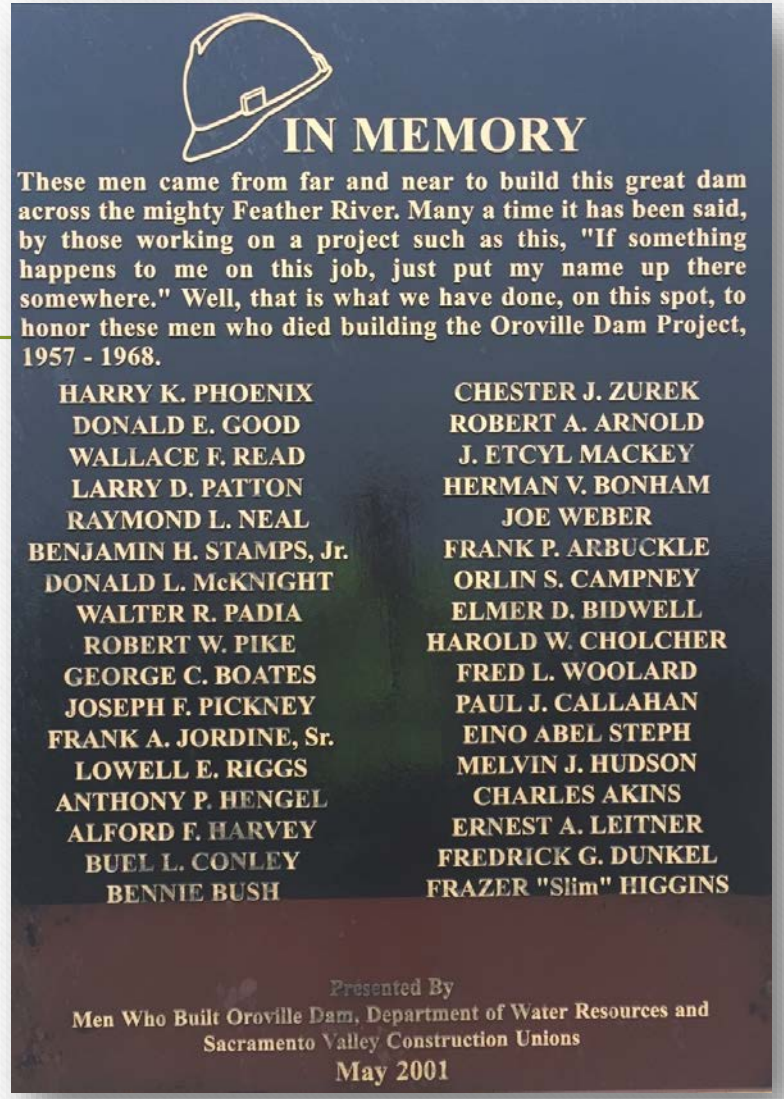
- **CFS** - Cubic feet per second, used to reference the volume of water being released from the primary and emergency spillway. (1 CFS = 7.48 gallons per second, essentially one basketball)
- **In flow** - The volume of water entering Lake Oroville.
- **Out flow** - The water being released from Lake Oroville through the primary spillway/emergency spillway and/or Hyatt Power Plant.
- **Tailrace** - The outflow water channel below a dam or hydroelectric power plant.
- **Acre foot** - Sheet of water one acre in size (43,560 ft^2) to a depth of one foot.
- **Cofferdam** - Watertight enclosure pumped dry too allow access to an area or machinery normally submerged. Often used on dam and bridge construction.

Commonly used Terminology

- **Diversion pool**-A channel made to divert the flow of water from one course to another or to direct the flow of water draining from a piece of ground.
- **Primary Spillway**-The term Service spillway (primary spillway) as it applies to the area of reclamation can be defined as a structure located on or adjacent to a storage or detention dam over or through which surplus or floodwaters which cannot be contained in the allotted storage space are passed, and at diversion dams to bypass flows exceeding those which are turned into the diversion system.
- **Emergency Spillway**-When water levels reach 901 within the Lake Oroville the emergency spillway will become active. This is an uncontrolled spillway meaning there is no way to control the outflow of water. *(Never been utilized prior to 2017)*
- **Hyatt Power Plant**-An underground, hydroelectric, pumping-generating facility located at the based of the earthen Dam.

Oroville Dam Statistics

- The Oroville Dam was completed in 1968
- Oroville stands as the tallest earth-fill dam (770 feet in height) in the United States and among the top 20 in the world.
- At capacity the lake contains 3.5 million acre feet of water.
- Dam is 1 mile long across the top and a 1 mile thick at the base.



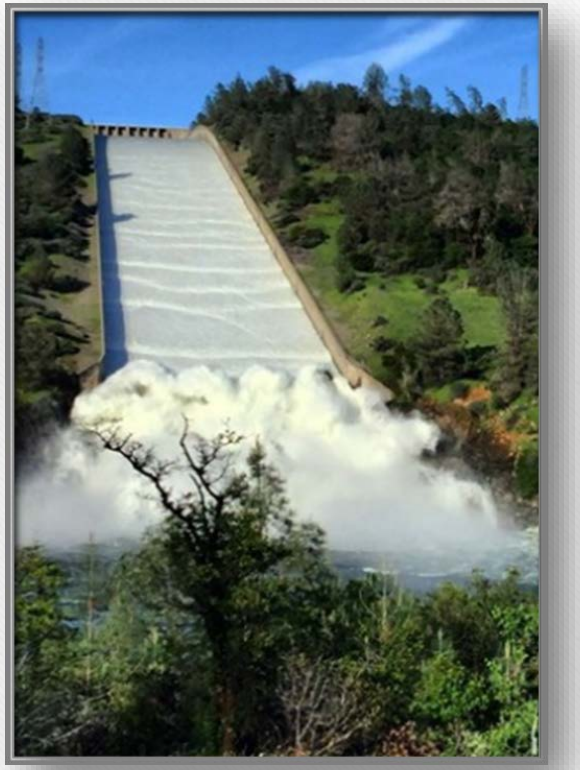
Lake Oroville
Emergency Spillway
Oroville Dam
220 KV Powerlines
Primary Spillway
Hyatt
Power Plant
Approx. location of damage
to Primary Spillway
Cofferdam
Tailrace
Diversion Pool

Background

- During the 2016/2017 winter, in an effort to reduce water levels DWR was releasing 65,000 CFS from the primary gated spillway in anticipation of upcoming precipitation/snow melt.
- On February 7th, 2017 damage to the primary spillway was identified.
- The damage was identified as significant enough to warrant an order for total shut down of spillway operations at 1100 hrs. Spillway was shut down by 1300 hrs.

Oroville Primary Gated Spillway Statistics

- The Primary Gated Spillway is 179 feet in width and 3,055 feet long.
- The maximum normal high flow rate of the primary spillway is 150 thousand CFS. *(1,122,000 million gallons per second)*
- The maximum design flow rate capability is 296 thousand CFS.

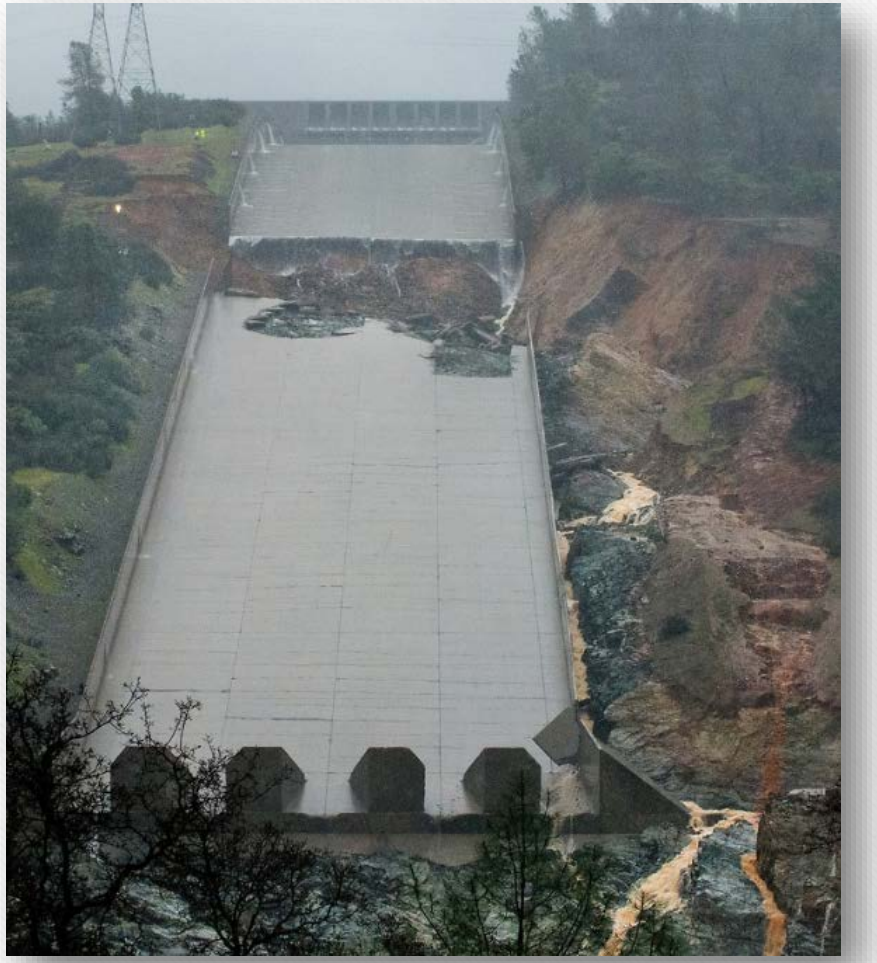


Oroville Emergency Spillway Statistics

- Emergency Spillway is 1700’ feet long.
- Maximum lake level elevation of the Emergency Spillway is 901’.
- Constructed as interlocking concrete monoliths with native soil and rock tail out surfaces covered with grass and trees extending 30-40ft deep.
- The Emergency Spillway has never been used since the dam was constructed. (*until now*)
- It’s an **uncontrolled** emergency spillway.

Progression of Primary Spillway Damage

- The hole under the spillway continued to expand.
- Undercutting started to cause structural failure up hill in the direction of the spillway gates.
- Spillway side walls also began to fail causing water to flow along the side of the spillway.



Incident Management Team 3

Expectations during Team Transition

- Written letter of expectations outlining clear leaders intent (This was modified more than once)
- Current MOU agreement between CAL FIRE and DWR
  - Efficiency
  - Effectiveness
  - Safety
  - Support and Assist

Kevin Lawson

Incident Commander

CAL FIRE Incident Management Team 3

- All hazard incident low frequency vs. high impact/risk
- Information vs. Intelligence
- Persistence forecasting (Think days, weeks, months ahead)
- Team process vs. DWR process internal and external
- Remain fluid (flexible can be even be to rigid)
- Unity of objective (Working as one team/one mission to accomplish the objectives)
- Be humble (Ego's need to be checked at the door)
- Surrounded by subject matter experts CAL FIRE & DWR

Incident Potential

- The highest probability potentials involved failure of the Emergency Spillway
- Flooding/failure of the Hyatt Power Plant
- Failure of the emergency spillway could potentially cause a domino effect to other infrastructure related to the Oroville Dam.
- Failure of the emergency spillway projected an instantaneous outflow of 1,000,000 acre feet of water.
- Inundation maps projected significant flooding throughout the City of Oroville (Butte County), south into the west metropolitan Sacramento area.
- Failure of the Hyatt Power Plant would cause significant long-term impacts to water supplies throughout the valley.

Incident Potential

- Potential failures of canals, and reservoirs
- Significant environmental and ecological impacts (Fish hatchery)
- Primary water supply to Southern California compromised

Infrastructure Threat

- Infrastructure Affected
- Actions Taken
- Implications of loss

Incident Management Team 3

Management Objectives

- Provide for the protection of public health and welfare, and for the safety of all first responders.
- Maintain the integrity of the Oroville Dam.
- Continue to monitor and assess the damage to the Lake Oroville Spillway.
- Ensure coordinated, timely and accurate release of public information to all stakeholders: public, responding agencies and all agencies affiliated with Department of Water Resources..
- Maintain the operational availability of the Hyatt Power Plant.
- Maintain the integrity and operational availability of the Thermalito Diversion Dam.

Incident Management Team 3

Operational Objectives

- Continue work to repair emergency spillway and keep operational.
- Validate readiness and implementation of mitigation measures.
- Apply flood mitigation measures to protect the Hyatt Powerhouse.
- Coordinate air space within Temporary Flight Restriction (TFR) (4 miles and 4500ft).
- Early coordination between adjoining counties and local EOCs.

Daily Meetings/Conference Calls

- Meetings
  - 0600 Morning Operational Briefing
  - 1000 Cooperators Meeting
  - 1530 Tactics/Strategy Meeting
  - 1700 Planning Meeting
  - Team Meeting (Every other day)
  - C & G Meeting
- Conference Calls
  - DWR & Department Operations Center (DOC)
  - CAL FIRE & Cal OES
  - IC & State Operations Center (SOC) (2x daily)
  - IC to Region Duty Chief (RDC) (2x daily)
  - IMT3 & IMT 4 with North Ops

Incident Management Team 3

Integration with DWR

- Support, assist and mentor DWR Staff
- Willingness of DWR to listen and learn
- IMT members being humble
- IMT members being fluid at all levels and throughout the duration of the event
- Relationship both internal and external
- Clear communication amongst C&G staff both vertically and horizontally with accountability
- DWR members working long hours typically out of their comfort zone
- High stress low frequency event
- Scope of the incident (geographically and jurisdictionally)

Incident Commander (Unified)
D - Pat Whitlock
530-990-4300
N - Doug McElvain
661-333-4104
Kory Honea - BCSO
Kevin Lawson - IMT 3
Barry Biermann - IMT 3
Justin McGough - IMT 3

Deputy Incident Command Support
Joel Lesdesma
916-849-4779
Behzad Soltanzadeh
916-653-0772

Security Officer
D - Roger Baker
530-990-1775
N - Curtis Green
909-809-7117

Liaison Officer
D - Matt Murray
530-321-6035
N - None
Mike Martin - IMT 3
Dennis Carreiro - IMT 3

Safety Officer
D - Mike Parreira
559-836-2959
N - None
David Sargenti - IMT 3
David Brockman - IMT 3

Public Information Officer
D - Kevin Dossey
530-521-3503
Mike Smith - IMT 3

Deputy Operations Section Chief
Bill Cochran
530-588-4748

Operations Section Chief
D - Tom Cobarrubia
916-952-9376
D - John Berringer
916-952-9376
N - Nate Smith
530-219-5948
Nick Truax - IMT 3
Jeff Ohs - IMT 3
Nick Schuler - IMT 3

Staging Area Manager
D - John Personeni
916-539-7726
N - None

Floating Debris Removal Strike Team
D - Ed Elliott
530-520-4582
N - None

Syblon and Reid Strike Team
D - Dan Ramsour
916-217-6733
N - None

Contingency Planning
D - Dave Rennie
916-698-5056
N - None

Planning Section Chief
D - Mark Hafner
530-401-8564
N - Phil LeCocq
916-402-9273
N -Andrew Steward 2/19-2/21
Buddy Bloxham - IMT 3
Jeff Dapper - IMT 3

Resource Unit Leader
D - Ravi Sharma
916-709-7756
N - MES
Shannon Johnson - IMT 3
Gabe Garcia - IMT 3

Situation Unit Leader
D - Kevin Robinson
916-642-3115
D - Ryan MacTarnaghan
916-801-6050
N - None
Todd Tuggle - IMT 3
Josh Black - IMT 3

Documentation Unit Leader
D - Alyssa Stutz
530-592-9832
N - Scott Kennedy
530-524-4164

Engineering Shop
D - Tim Wehling
916-653-7336
N - Scott Hunt
916-574-2665

Logistics Section Chief
D - Wendy Underhill
530-448-7247
N - Richard Jones
661-400-0321
Geoff Pemberton - IMT 3

Support Branch Director
D - Ken Dunn
530-521-8487
N- None

Supply Unit Leader
D - Ken Dunn
530-521-8487
N - None

Facilities Unit Leader
D - Wendy Underhill
530-448-7247
N - None
Richard Tovar - IMT 3

Ground Support Unit Leader
D - Chuck Saiz
530-370-2120
N - None
Steve Langston - IMT 3

Services Branch Director
D - Wendy Underhill
530-448-7247
N - None

Communications Unit Leader
D - Wendy Underhill
530-448-7247
Mark Chadwick
N - None
Kris Yeary - IMT 3

Medical Unit Leader
D - Barbara Holbrook
530-215-8222
N - None
Kris Yeary - IMT 3

Food Unit Leader
D - Wendy Underhill
530-521-8487
N - None

Finance/Admin Section Chief
D - Jessica Roles
530-521-4910
N - None
Terry Eastwood - IMT 3

Time Unit Leader
D - Karen Cawthon
530-534-2373
N - None
Patrick Aguada - IMT 3

Procurement Unit Leader
D - Deanna Butler
530-521-2516
N - None

Comp. Claims Unit Leader
D - Jessica Roles
530-521-4910
N - None
Paul Rotondaro - IMT 3

Cost Unit Leader
D - Lynne Esparza
530-534-2372
N - None
John Forsberg - IMT 3

Incident Management Team 3

Incident Commander's Successes

- The line officer from the Butte Unit was very engaged, knowledgeable of the situation and key personnel involved.
- This incident required the complete integration of the entire team, an "outside the box" All Hazard plan, development and issue mitigation, as well as complete transparency in communication.
- Hosted numerous briefings and media events for the community, media, and legislators.
- Daily cooperator meetings identified critical issues early, and led swift mitigation measures.
- Initially having the Acting Director of DWR at the ICP was critical to ensuring an effective plan with support from Sacramento, for rapid decision making and execution.
- Unified Command worked well by ensuring all information was vetted, and a plan was developed to be presented by a single voice. The Butte County Sheriff was critical to this process and supported the plan 100%.
- DWR staff willingness to learn, listen and lead.

Incident Management Team 3

Incident Commander's Challenges

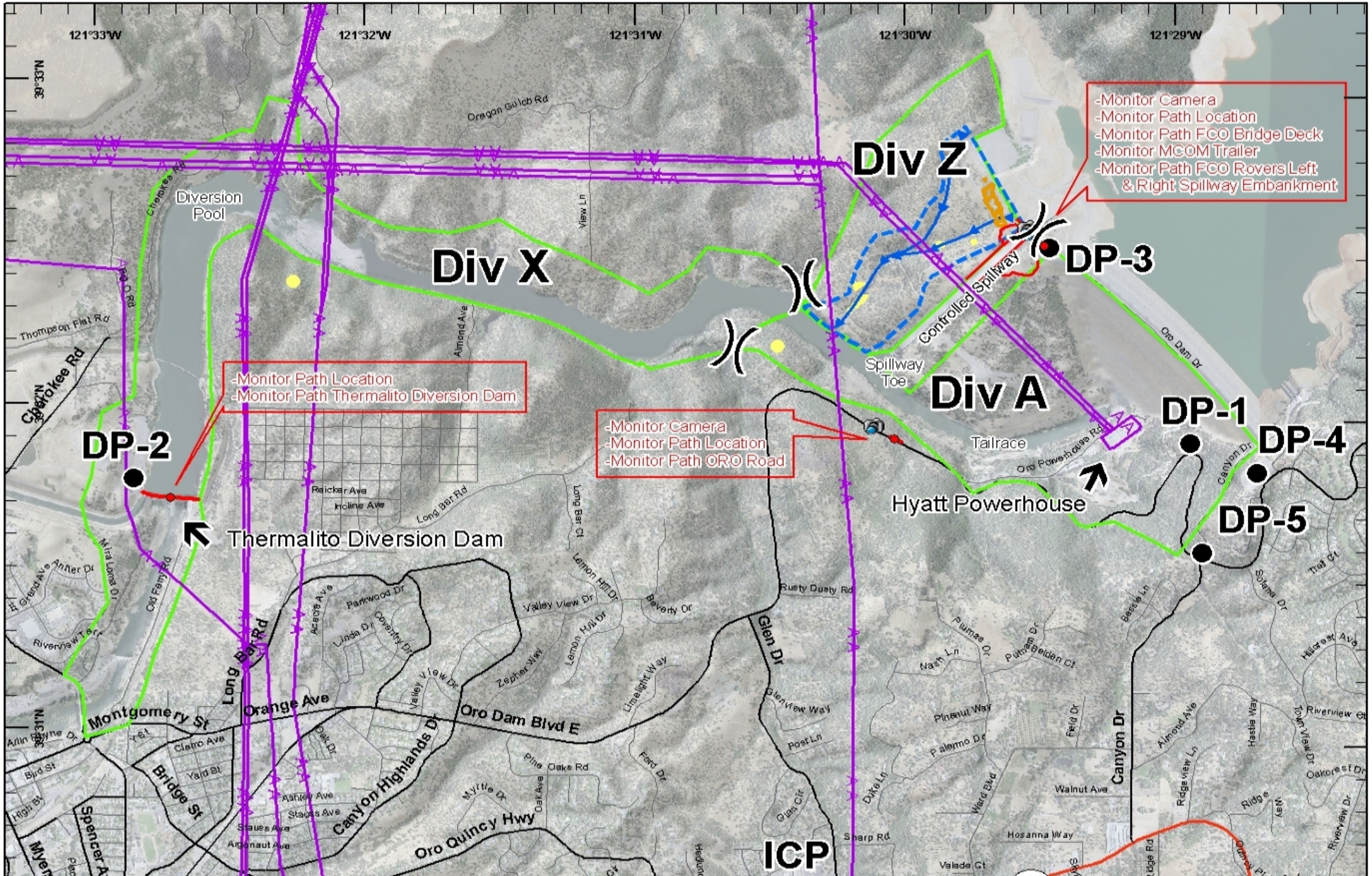
- Numerous outside distractors hampered the planning process. Conference calls, unscheduled visits and tours, etc.
- Communication from all involved parties lagged at times, and led to frustration. This process was worked through.
- Steep learning curves experienced by DWR in regards to ICS, processes, nomenclature, etc. This too was worked through, but could be improved upon through, additional ICS training and table top exercises between CAL FIRE and DWR.
- Turnover of key DWR personnel mid-incident led to delays and slowed down the process.
- Initial process with DWR vetting through Sacramento / Department Operations Center (DOC) impeded the process.
- Too many decisions and inputs being made from outside the established ICP.

Incident Management Team 3

Elected Officials Briefing

- Senate pro Tem Kevin De León
- Senator Robert Hertzberg
- Senator Jeff Stone
- Senator Holly Mitchell
- Senator Jim Nielsen
- Senator Tom Berryhill
- Assemblymember Eduardo Garcia
- Assemblymember Bloom
- Assemblymember Freddie Rodriguez
- Assemblymember Adam Gray
- Assemblymember Heath Flora
- Secretary John Laird

Spillway DWR
17-CA-CDF-000114
02/21/2017
0600 - 0600
NAD83



Precautionary Actions Taken

Large rock and concrete slurry was installed at the bottom of the spillway to reduce potential erosion if the water was to crest the emergency spillway

https://www.youtube.com/embed/3EdqKdjH3sA

February 12th 2017

Lake elevations rise to 901ft and water begins flowing over the emergency spillway at a rate of approximately 120 million gallons per hour.

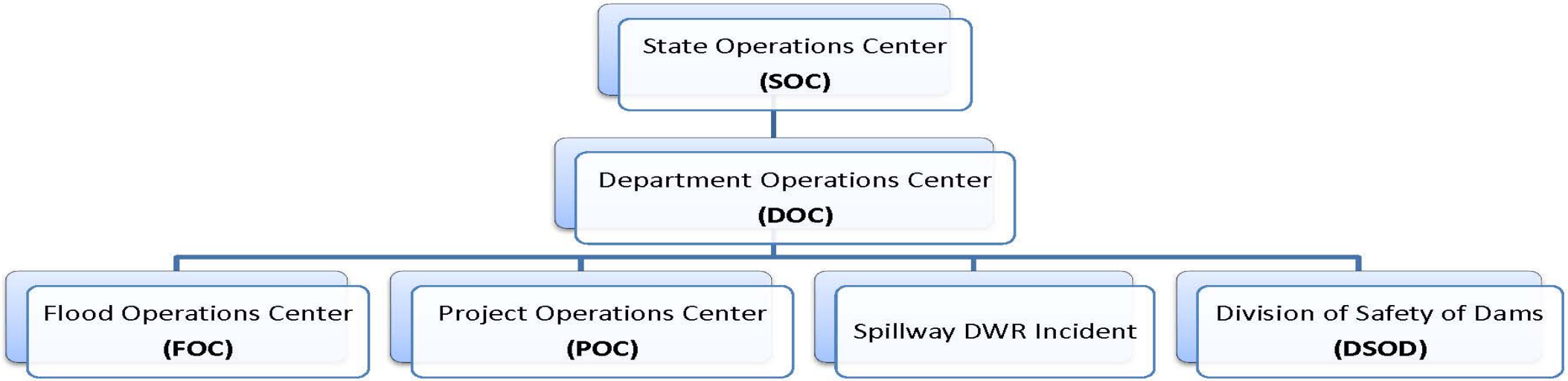
https://www.youtube.com/embed/T5zumuQIMV0

State Operations Center Activation

Level 4

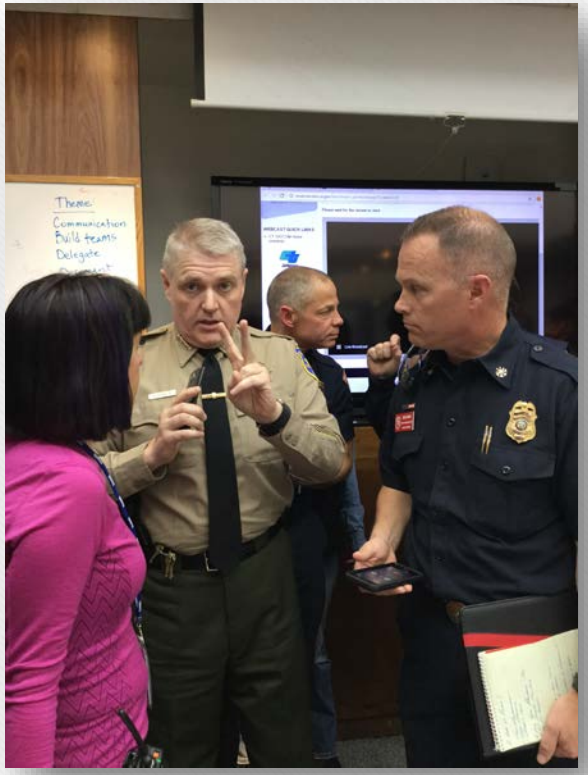
- Coordinates all Mission Tasking of Resources Statewide.
- Federal Emergency Management Agency (FEMA) Team coordinating federal assistance.
- 24 Joint Information Center (JIC)

ORGANIZATION CHART



Briefing of Command Staff

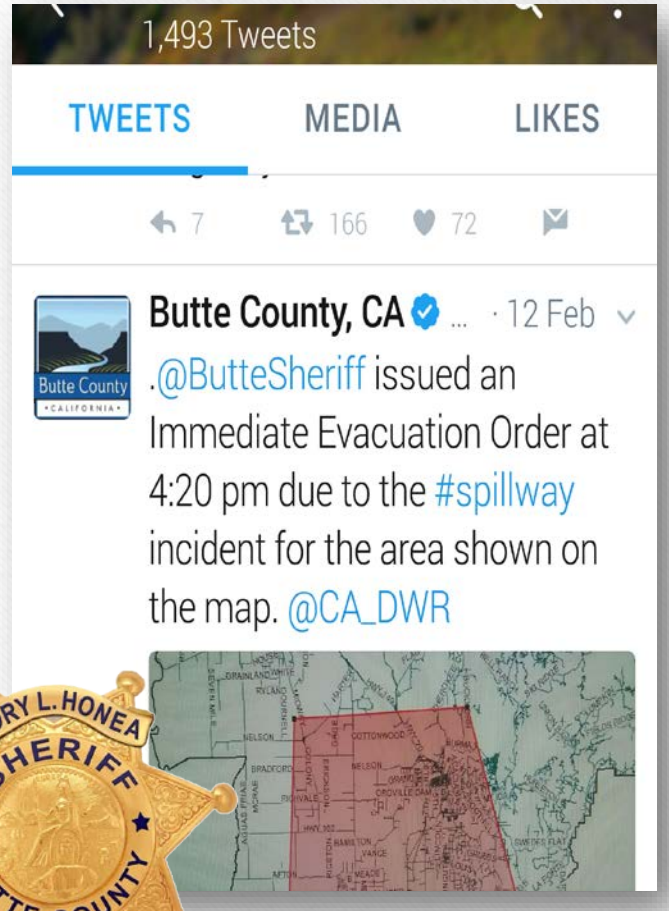
- Given the updated intelligence, DWR subject matter experts were brought in to brief commanders on the potential for a catastrophic emergency spillway failure.
- Intelligence was given to Command Staff to aid in decision making from the subject matter experts focused on geological deterioration rate and what the results of a failure of the emergency spillway would be.
- A total dam failure inundation map was provided and explained to the Command Staff. *The inundation map for the emergency spillway was not available at the time the decision was make to evacuate.*



Immediate Evacuation Order Issued

February 12th 2017

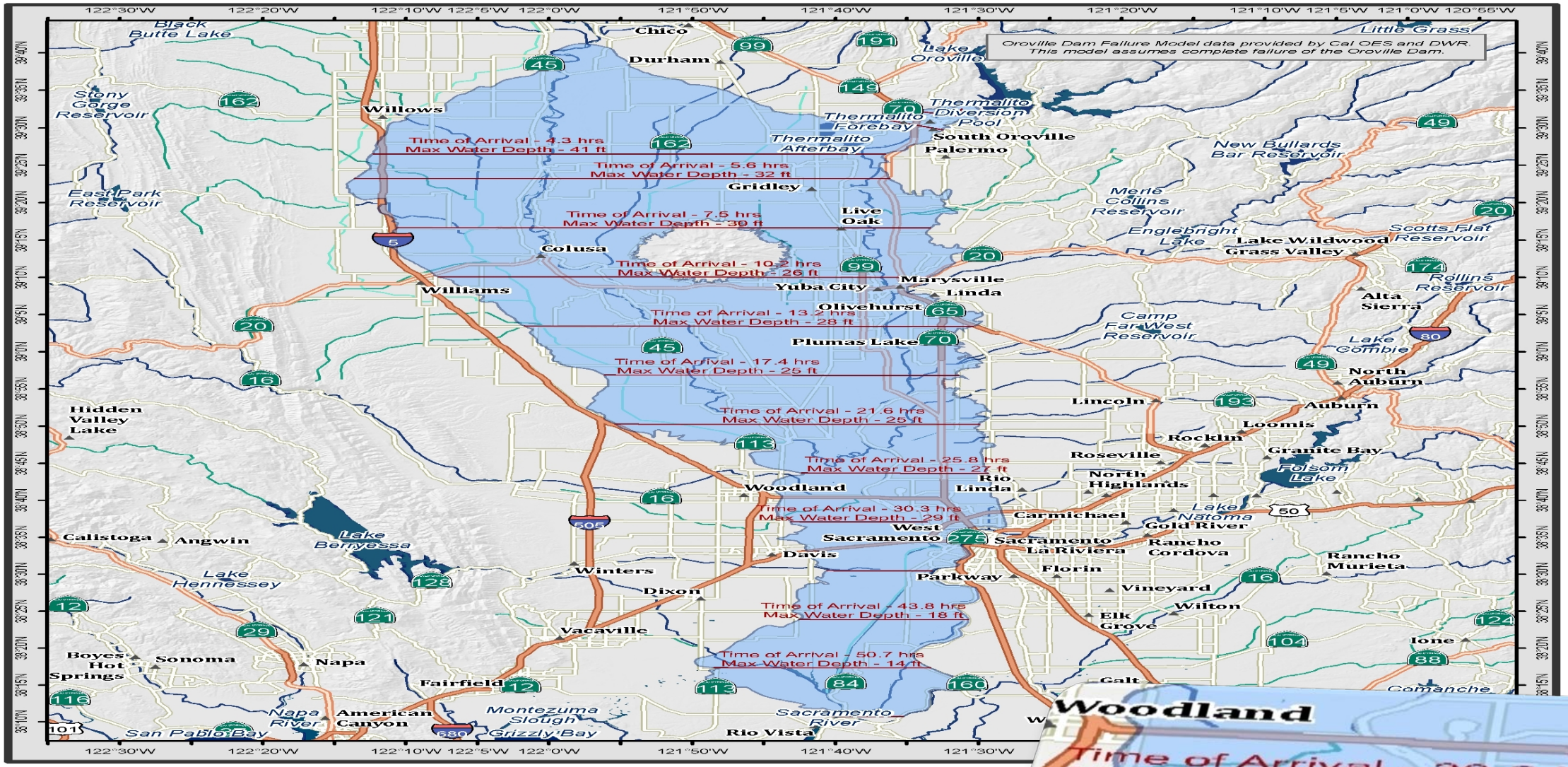
- Immediate evacuations were ordered for counties and cities near Lake Oroville.
- A population of approximately 188,000.
- Many evacuees evacuated to Chico which is approximately 30 minutes North of Oroville. Several evacuation shelters were established.
- Butte County Jail (578 inmates), were evacuated to Santa Rita Jail in Alameda County.



February 12th 2017

- Decision was made to transition into Unified Command with CAL FIRE Incident Management Team 3, DWR, and Butte County Sheriff's Department based upon potential implications of a catastrophic failure of the Emergency Spillway failure.

- Evacuation of ICP
- Initial press conference
- Community meeting
- Updated press conference
- Determination the original ICP was deemed safe



Team 3 GIS
NAD 83

1:1,000,000
Miles
0 3 6 12

Dam Contingency Map

Spillway DWR 17-CA-CDF-000114

February 23, 2017

Emergency Proclamations and Declarations

- February 12, 2017 - Governor Brown Issues Emergency Order to Help Response to Situation at Oroville Dam.
- February 13, 2017 - Request for Emergency Declaration for Direct Federal Assistance for Butte, Yuba and Sutter Counties.
- February 14, 2017 - President Trump Approves California Emergency Declaration. FEMA-3381-EM-CA *Emergency protective measures, limited to direct federal assistance, will be provided at 75 percent Federal funding.*

February 13th 2017

- Catastrophic failure of the emergency spillway averted.
- Water flowing over the emergency spillway ceased.
- The evacuation order remained in effect.
- Primary spillway continued to flow at 100,000 CFS which causes a rise in tailings at the end of the primary spillway.
- Tailings are causing a rise in water elevation of approximately 25ft which now threatens the Hyatt Powerplant.
- Overnight four options are identified to reduce the threat.

- https://www.youtube.com/embed/UyvDPt-HU3g

Recommendations and take aways

- Remain fluid, and immediately identify the "process" and stick to it.
- A light footprint with a cooperative attitude and approach by the team reinforced we are there to help, not take over from the requesting agency.
- Understand that while most agencies understand what ICS is with minimal training, they do not have enough experience to fully function within it without guidance.
- You can not over communicate in these situations. What appears to be routine to the team may not be that easy for other non emergency agencies.

Recommendations and take aways

- Be cautious of cooperating agencies trying to perform their daily jobs during an emergency. Clear expectations from all Unified IC's is critical.
- Incident Command Post location
- Validation of Emergency Action Plans (EAP) need to be referenced updated and trained on annually.
- You need to understand partnering agencies have different missions, politics, needs, and mind sets.

Recommendations and take aways

- Emergency Action Plans (EAP) need to be exercised and validated
- Depth in ICS positions (civilians not accustom to working environment)
- Displacement of residents outside of local and state jurisdictions

DWR

- Lack of Incident Command Experience (ICS)- Not their daily norm!
- Minimal exposure to CAL FIRE IMT's
- Challenges of Reservoir Level (monitoring, notifications, infrastructure)
- They do not know what they don't know
- Excellent attitudes and the ability to listen and learn
- 14 plus hour shifts, vacations, relief