

Yuba Feather FIRO Preliminary Viability Assessment Executive Summary

December 2022

California has one of the most variable climates in the United States, and it's getting more extreme, marked by long periods of warm, dry conditions punctuated by stronger and wetter atmospheric river (AR) storms. ARs provide half of the state's annual precipitation but cause more than 90 percent of the floods in Northern California. Communities in parts of the Yuba-Feather watersheds still haven't fully recovered from devastating floods in 1986 and 1997.

Recognizing the importance of ARs in a changing climate, Yuba Water and the California Department of Water Resources (DWR) are working with Scripps Institution of Oceanography's Center for Western Weather and Water Extremes (CW3E) at UC San Diego, the U.S. Army Corps of Engineers (USACE), the National Weather Service, and other members of the Yuba-Feather Steering Committee to implement Forecast Informed Reservoir Operations (FIRO) at New Bullards Bar (NBB) and Lake Oroville (ORO) in the Yuba and Feather River watersheds. FIRO is a flexible water management strategy that uses improved weather and runoff forecasts to help water managers retain or release water from reservoirs to increase resilience to droughts and floods. The primary objective of this FIRO project is to reduce flood risk; a secondary objective is to achieve water supply benefits where possible, while supporting environmental needs.

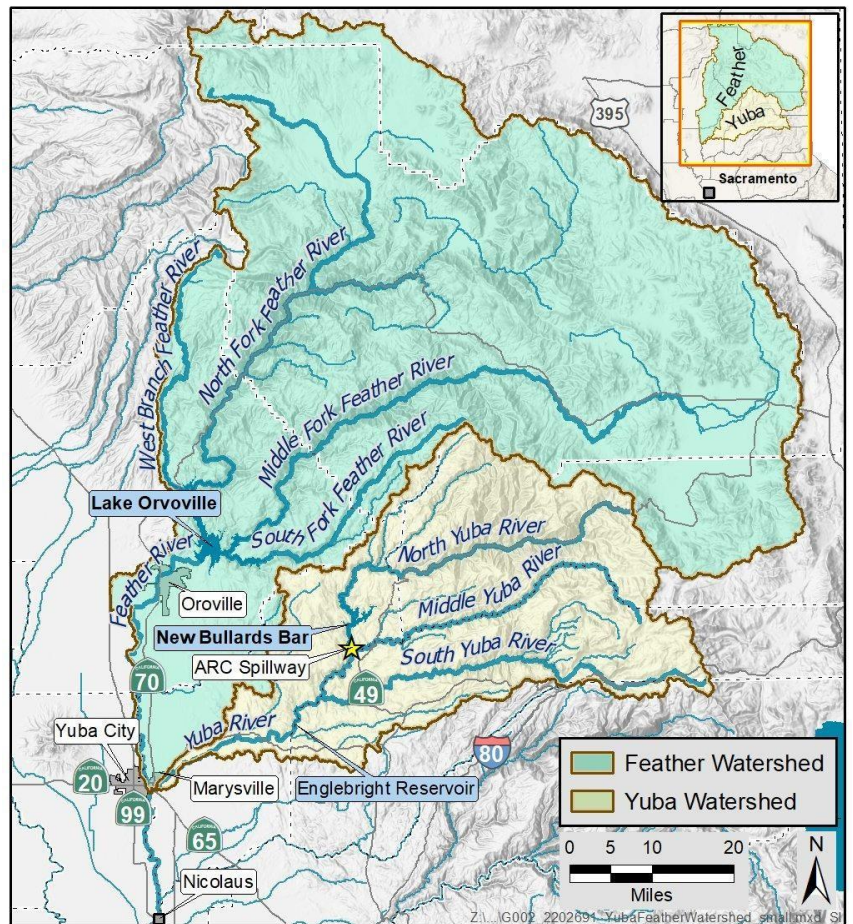


Figure E-1. Yuba-Feather watersheds.

This FIRO Preliminary Viability Assessment (PVA) indicates strong potential for FIRO to be a viable water management strategy for reducing flood risk in the Yuba and Feather River watersheds.



Figure E-2. Lake Oroville (left) and New Bullards Bar (right) in the Yuba-Feather watersheds

Unique Aspects of the Yuba-Feather FIRO Assessment

- Flood risk reduction as a primary objective
- Complex operational constraints
- Rain and snowmelt driven hydrology
- Multiple reservoirs under different ownership
- Forecast-Coordinated Operations in place
- Simultaneous Water Control Manual (WCM) updates

The Yuba-Feather FIRO research and operations partnership, formed in 2019, has two primary elements: improving precipitation and runoff forecasts, especially for large AR events, and integrating improved forecasts into new reservoir operations to improve operational flexibility. Data driving FIRO include weather data collected from reconnaissance flights over the Pacific Ocean, weather balloons launched during AR storms, and a growing network of weather stations that collect continuous real-time data to ground-truth conditions, including soil moisture, which is critical for more accurate runoff predictions. A robust AR research program is central to improving precipitation forecast accuracy and lead times, thus achieving greater benefits in meeting FIRO objectives over time.

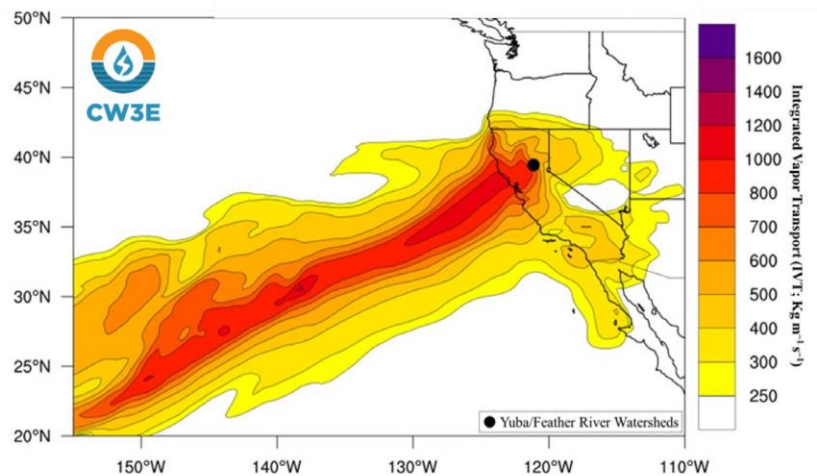


Figure E-3. Image of a strong AR that impacted the Yuba-Feather watersheds on February 7, 2017.

The PVA assessed whether improved precipitation and runoff forecasts can reduce flood risk below the NBB and ORO reservoirs, based on multiple flood risk metrics. The primary flood risk reduction method is reservoir releases ahead of large storm events (i.e., pre-releases), which creates additional temporary flood storage space for anticipated inflows. However, there are

limitations on downstream flows, so flood storage volume, elevation to spillway crest, and peak downstream flows all need to be considered in the analysis.

FIRO evaluation considered current operations and two FIRO alternatives that were assessed within the context of Forecast-Coordinated Operations, the system DWR and Yuba Water use to coordinate releases from ORO and NBB. Based on the PVA experience, refinements will be made for the Final Viability Assessment (FVA) to determine how best to meet the objectives for each reservoir, as well as points downstream.

Key Findings of the Preliminary Viability Assessment

- FIRO has the potential to enhance flood risk management without impacting water supply.
- Frequency of exceeding key pool elevations, outflows, and downstream flows is generally reduced with the preliminary FIRO alternatives when compared to existing WCM operation.
- End-of-event storage, a cursory indication of water supply reliability, is generally increased.

To better leverage forecasts, Yuba Water is designing a second spillway for NBB that allows for greater forecast-informed pre-releases at lower reservoir elevations. Using FIRO with the planned spillway will enable the management of up to an additional 117,000 acre-feet of reservoir space and the potential to reduce water levels on levees near Marysville by 2 to 3 feet.

The FVA, to be completed in 2023, will further refine and assess the alternatives and test them against projected climate change hydrology, with the FIRO implementation phase beginning in 2024. USACE is updating its WCMs, which govern reservoir flood operations for both reservoirs, in parallel with the FVA to ensure FIRO integration into reservoir operations by 2026.

Yuba-Feather FIRO & WCM Timeline



Yuba-Feather FIRO Steering Committee: John James (Yuba Water, co-chair), John Leahigh (DWR, co-chair), Marty Ralph (CW3E, co-chair), Cary Talbot (USACE), Joe Forbis (USACE), Mike Anderson (DWR), Molly White (DWR), Alan Haynes (National Weather Service), and Steven Lindley (National Marine Fisheries Service).

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