

Prado Dam FORECAST INFORMED RESERVOIR OPERATIONS FINAL VIABILITY ASSESSMENT

November 2023



California has one of the most variable climates in the United States, and it's getting more extreme, increasingly 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 and cause more than 90 percent of flood damages.

Forecast Informed Reservoir Operations (FIRO) is an innovative approach that provides resilience to these extremes by using modern forecasting methods to selectively retain or release water from reservoirs in anticipation of future weather conditions.

The U.S. Army Corps of Engineers (USACE) constructed Prado Dam in 1941 for flood risk management. Since then, USACE has collaborated with Orange County Water District (OCWD), which provides water for over 2.5 million people. In 2018, OCWD initiated a Research and Operations Partnership with USACE and the Center for Western Weather and Water Extremes (CW3E) at Scripps Institution of Oceanography, U.C. San Diego, to test FIRO for improving water supply reliability, while not impairing and possibly enhancing habitat and flood risk management. This is accomplished by temporarily retaining flood flows behind the dam (buffer pool), which are then released at rates that can be recharged to the Orange County groundwater basin using improved forecasting of major AR events. The current buffer pool stores a maximum of 20,000 acre-feet at an elevation of 505 feet (Figure 2).

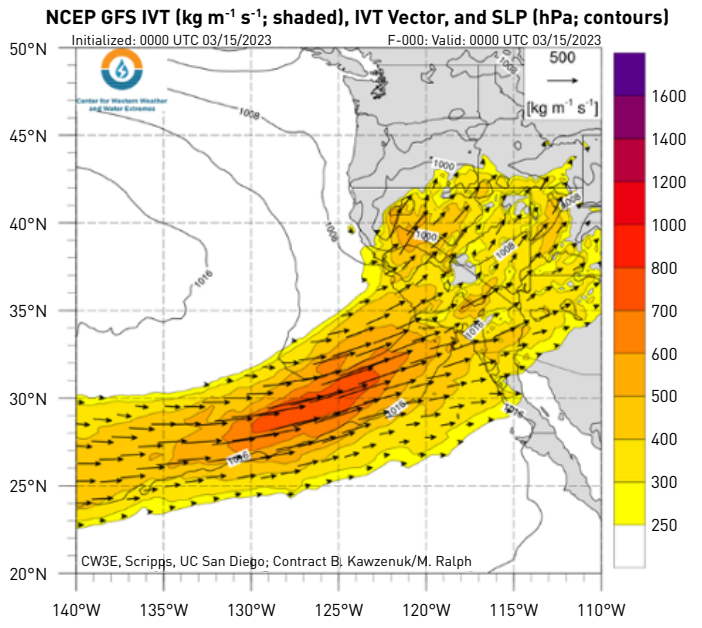
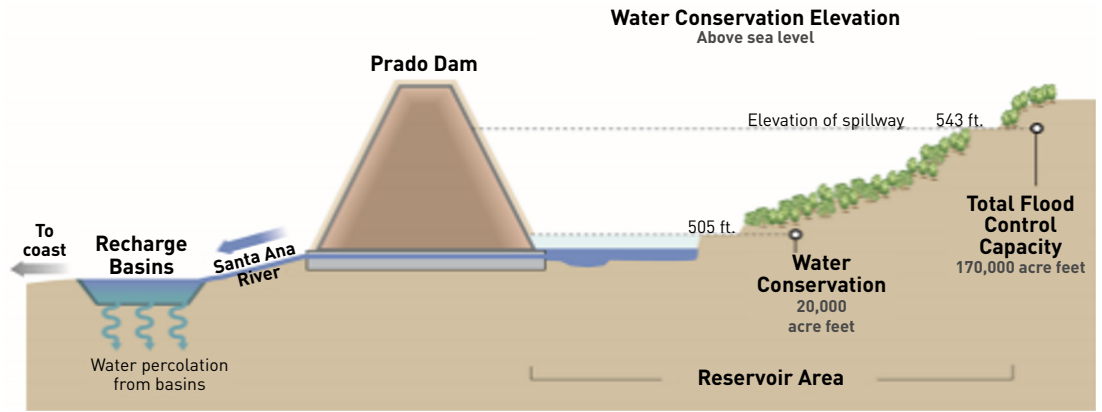


Figure 1. A landfalling AR on 15 March 2023, one of 16 that contributed to an average of 29 inches of precipitation in the Los Angeles basin.

Figure 2. Schematic of Prado Dam water conservation elevation for stormwater storage and capture (credit: OCWD).



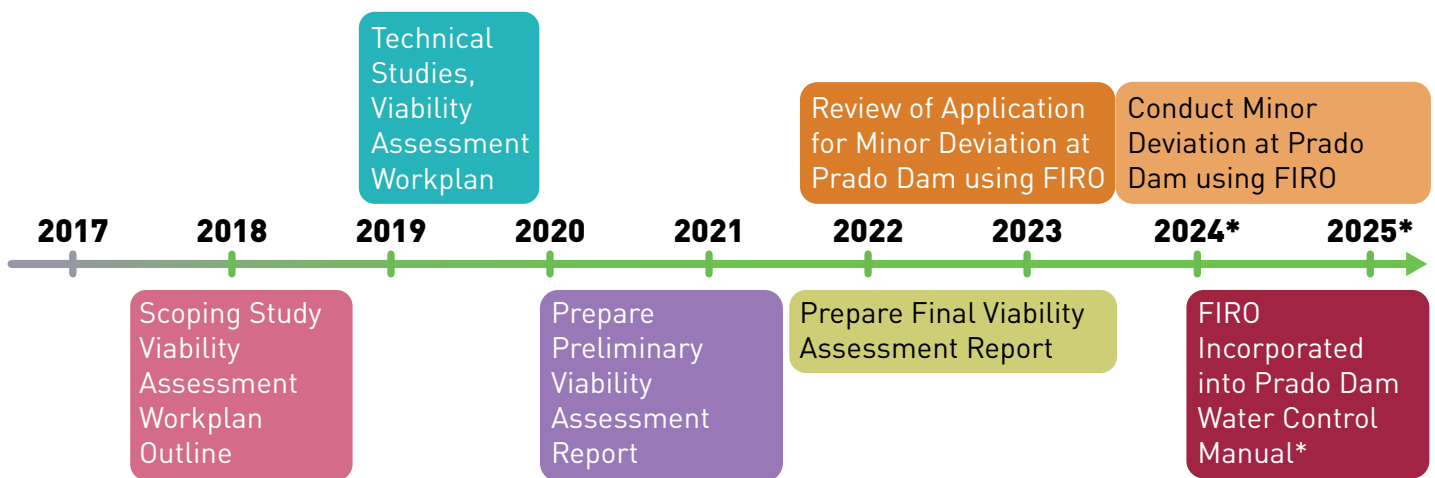
To evaluate FIRO, modeling and other analyses were conducted to test FIRO operations at buffer pools up to elevation 520 feet. The USACE will consider the FVA recommendations in a future update to the Prado Dam Water Control Manual, which is the document the USACE uses to operate Prado Dam. The update to the Water Control Manual to incorporate FIRO is targeted for 2027 (Figure 3).

Key Findings

- FIRO strategies from elevation 510 feet to 512 feet would yield approximately 4,000 to 6,000 acre-feet of additional groundwater recharge annually over existing operations.
- FIRO strategies have a slight positive impact on flood risk management outcomes for all buffer pools tested up to 520 feet.
- All FIRO strategies at all buffer pools perform better than the baseline (current WCM) when considering the frequency of exceeding 520 feet.
- There are no identifiable environmental impacts associated with FIRO alternatives; in fact, there are some indications of positive impacts at higher water levels. Additional monitoring is needed to adjust water levels as needed during FIRO operations.

Key Recommendations

- Based on the work conducted for the FVA, the Prado Steering Committee recommends that a buffer pool of 510 ft or perhaps 512 ft be explored during the interim operations period before the Water Control Manual is updated in 2027.
- AR tools, observations, and precipitation forecast products should be tailored to the Santa Ana River watershed to support real-time operations at Prado Dam and, in the future, coordinated FIRO operations with upstream Seven Oaks Dam.
- Work to evaluate potential improvements and advances in meteorological and hydrologic forecasting models should continue for additional FIRO benefit.



End dates for Minor Deviation and Water Control Manual Update not shown
 *Timeline dependent on hydrology and completion of the Santa Ana River Mainstem Project

Figure 3. Prado Dam FIRO Timeline.



Center for Western Weather and Water Extremes
 SCRIPPS INSTITUTION OF OCEANOGRAPHY
 AT UC SAN DIEGO



SCRIPPS INSTITUTION OF OCEANOGRAPHY

