US Army Corps of Engineers Research & Development Fact Sheet

Forecast Informed Reservoir Operations (FIRO)

Description of Research

Recent meteorological advances indicate the potential for improved predictability of certain weather patterns including atmospheric rivers (ARs), naturally occurring weather phenomena which are the leading cause of floods in the western United States. Additionally, a recent update to the US Army Corps of Engineers Water Control Management Engineer Regulation (ER 1110-2-240) allows for forecast conditions to be used in planning water management operations. Therefore, a research effort is underway to investigate how a water management approach called Forecast Informed Reservoir Operations (FIRO) can improve water availability, enhance flood risk reduction, and achieve additional ecosystem benefits.

FIRO envisions advanced observation and prediction technology that can provide water managers more lead time to selectively retain or release water from reservoirs based on longer-term forecasts. When storms cause moderate-to-high reservoir levels, normal operation is to release water to re-establish flood control space. Pilot studies being conducted at various reservoirs across the western U.S. have demonstrated that some of that water can be retained for future supply as long as no major precipitation is expected and it can be shown that the retained water can be released past downstream flood prone areas prior to the arrival of the next storm. This strategy permits earlier supply capture in some years, improving summer season supply reliability for downstream water users and improving the timing and volume of releases to protect water quality and provide flows needed for ecosystem benefits. Pilot studies have also shown that FIRO can decrease the potential for uncontrolled releases by signaling the need for preemptive releases ahead of large approaching storms. Optimizing reservoir operations in this fashion benefits water supply and environmental flows while also improving flood risk and dam safety.

FIRO viability assessments at the various pilot studies are guided by steering committees, composed of water management professionals, engineers and scientists from Federal, State, local agencies and academia, that explore the potential for FIRO at candidate reservoirs while also representing the range of stakeholder interests.

Current Status

There are six current FIRO pilot studies, each of which are following a timeline of site selection and steering committee formulation, work plan development, conducting a Preliminary Viability Assessment (PVA), followed by a Final Viability Assessment (FVA). The work plan, PVA and FVA steps produce published documents, with the PVA and FVA being peer reviewed. The PVA explores a broad range of possible FIRO operating scenarios at a given reservoir and the resulting analysis helps define a set of plausible candidate scenarios for more in-depth and detailed analysis in the FVA. Deviations from current operating conditions, as defined in the Water Control Manual (WCM) for each reservoir, are often recommended to provide means of testing the viability of various FIRO operating scenarios during the FVA process. The status of each of the six FIRO pilot studies is shown in the following figure.

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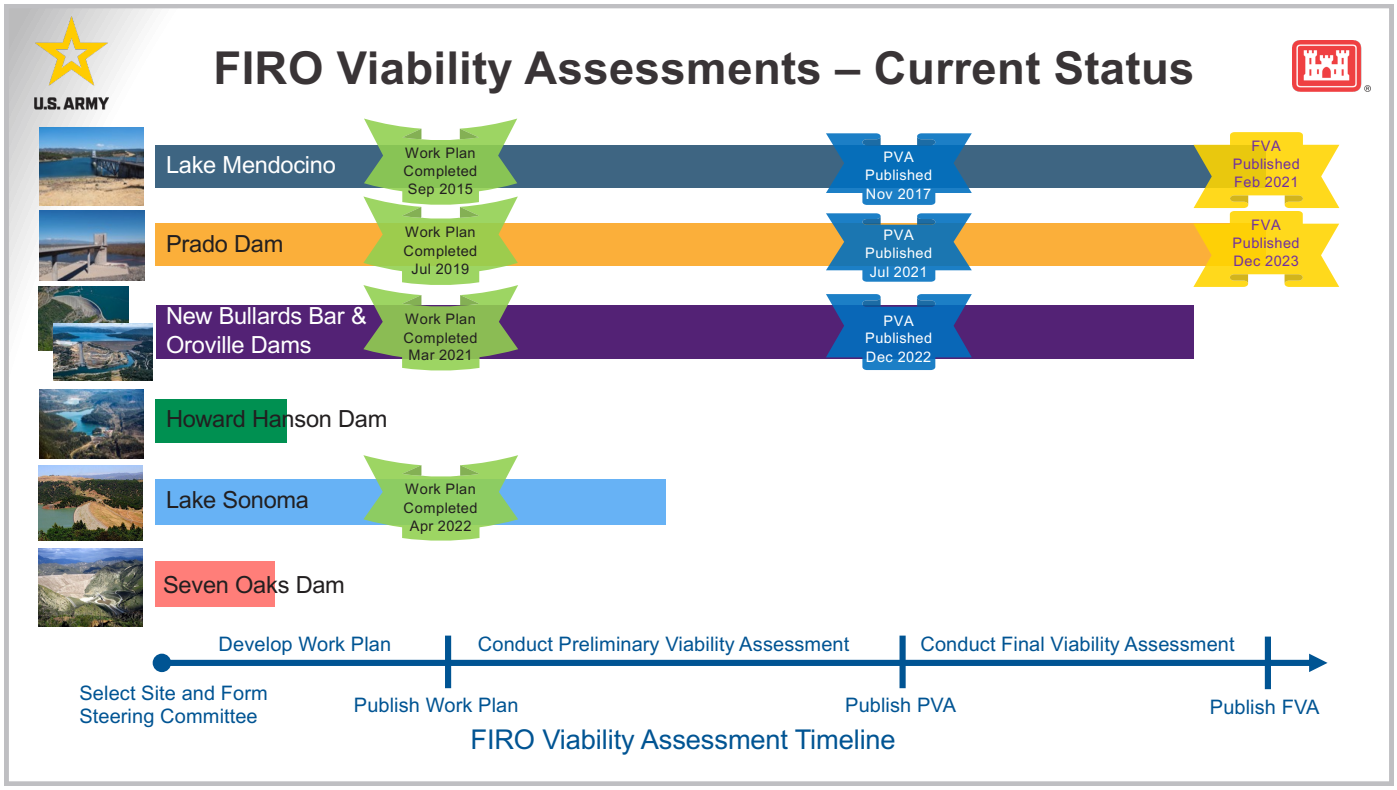

Using the lessons learned from the FIRO efforts to date, research and development of new science and technologies, particularly in the area of improved atmospheric forecasting capabilities, has continued with the goal of ensuring the safe and successful implementation of FIRO at reservoirs where it is applied. A campaign of airborne deployment of weather observation instruments by the US Air Force Reserve and NOAA aircraft is now conducted each winter season when AR systems impact the US. The observation data collected from these campaigns provide global weather forecast models with invaluable data for an area of great importance to detection and prediction of AR activity and which improve forecast skill for the entire North American continent and beyond. The effort has contributed to the establishment of an AR category of intensity scale, similar to the Saffir-Simpson hurricane intensity scale, that is used in warning and informing the public and emergency management officials of potentially damaging flood conditions from particularly intense AR storms. This category scale was developed by our FIRO partners, the Center for Western Weather and Water Extremes (CW3E), in February 2019 and is currently in use by weather forecasters and news outlets across the country.

Expected Outcomes

The FIRO viability assessments include analyses of various operating scenarios and, where warranted, recommendations for updates to WCMs that use tested FIRO scenarios which improve flood control, water availability and ecosystem benefits. The efforts also identify suites of actions ranging from practical, short-term steps to longer-term research needs. FIRO assessments suggest incremental improvements as science evolves and implementation criteria are met, following adaptive management principles for continual improvement of reservoir operations. In the case of the tested reservoirs, this hinges on opportunistically applying advances in monitoring and predicting precipitation and runoff. Lessons learned from the FIRO pilot studies are captured and inform a FIRO Screening Process being deployed as a tool for evaluating FIRO suitability at reservoirs across the entire country.

Point of Contact

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