Deviation Request Package
Coyote Valley Dam - Lake Mendocino

Introduction

Members of the Lake Mendocino Forecast Informed Reservoir Operations (FIRO) Steering Committee[1] submit this request for a major planned deviation to the Coyote Valley Dam – Lake Mendocino Water Control Manual (WCM). The purpose of this request is to improve water supply reliability and environmental conditions while maintaining flood management capacity of Lake Mendocino. This effort is being led by a steering committee formed in 2014 and consisting of representatives from the Sonoma County Water Agency (SCWA), Scripps Institute of Oceanography (Scripps), U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA), U.S. Geologic Survey (USGS), U.S. Bureau of Reclamation and the California Department of Water Resources.

As described below, Lake Mendocino has experienced significantly reduced water supply reliability over the past several years due to a significant reduction of trans-basin transfers into the facility from the Eel River. The goal of FIRO is to help restore some of the diminished water supply reliability without reducing the existing flood protection capacity of Lake Mendocino. The FIRO program is a water management program that uses data from watershed monitoring programs and improved weather and hydrologic forecasting to help water managers selectively retain or release water from reservoirs in a flexible manner that more accurately reflects and leverages the natural variability and predictability of meteorology and hydrology.

A substantial amount of work has been conducted to date as part of the FIRO program. A workplan was completed by the FIRO Steering Committee in July 2015 to establish a framework to evaluate the viability of FIRO for Lake Mendocino. In July 2017, the Committee completed the Preliminary Viability Study (PVA) that demonstrated the proof of concept of FIRO. The Steering Committee meets regularly to plan and develop strategies for funding, developing and implementing FIRO. In addition, staff from the participating agencies of the FIRO program meet annually to share information on work and developments completed to date.

This request for a planned major deviation to the WCM represents the next phase of the FIRO viability assessment and describes: (1) the basis for the requested deviation; (2) the details of the requested deviation; and (3) a description of the FIRO Steering Committee evaluation process. It is important to emphasize that if water levels are within the storage space allowed by this deviation, the USACE will have the discretion to utilize the additional information provided to inform (but not control) reservoir operations. USACE reservoir operators will retain full operational control and authority, with the FIRO decision support model (DSM) providing an additional tool for operators.

Basis for Requested Deviation

[1] The Lake Mendocino FIRO Steering Committee consists of representatives from the Sonoma County Water Agency (SCWA), Scripps Institute of Oceanography (Scripps), U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA), U.S. Geologic Survey (USGS), U.S. Bureau of Reclamation and the California Department of Water Resources. This deviation request is being submitted on behalf of steering committee members representing the following organizations: SCWA, Scripps Institution of Oceanography, USACE, NOAA, and California Department of Water Resources.

Coyote Valley Dam and Lake Mendocino are operated in accordance with the terms of the facility's WCM developed in 1958. The most recent revision of the manual was released in August 1986. Since the preparation of the WCM, significant changes have occurred throughout the Russian River system. These changes include the listing of Chinook, coho and steelhead salmon as threatened or endangered under the state and federal Endangered Species Act; and most importantly, significant reductions of inflow to Lake Mendocino due to lower diversions from the Eel River through Pacific Gas & Electric's Potter Valley Project (PVP).

Recent reductions in releases from PVP are the result of an Order issued by the Federal Energy Regulatory Commission in January 2004 that amended PG&E's operating license. Since 2006, when PG&E began operating under the amended license, there has been approximately a 57 percent reduction in the annual transfer of Eel River water into the Russian River Watershed. As shown in Figure 1 below, the average annual transfer through PVP between 1922 and 2006 was approximately 150,000 acre-feet. The average annual transfer through PVP between 2007 and 2017 was approximately 65,000 acre-feet.

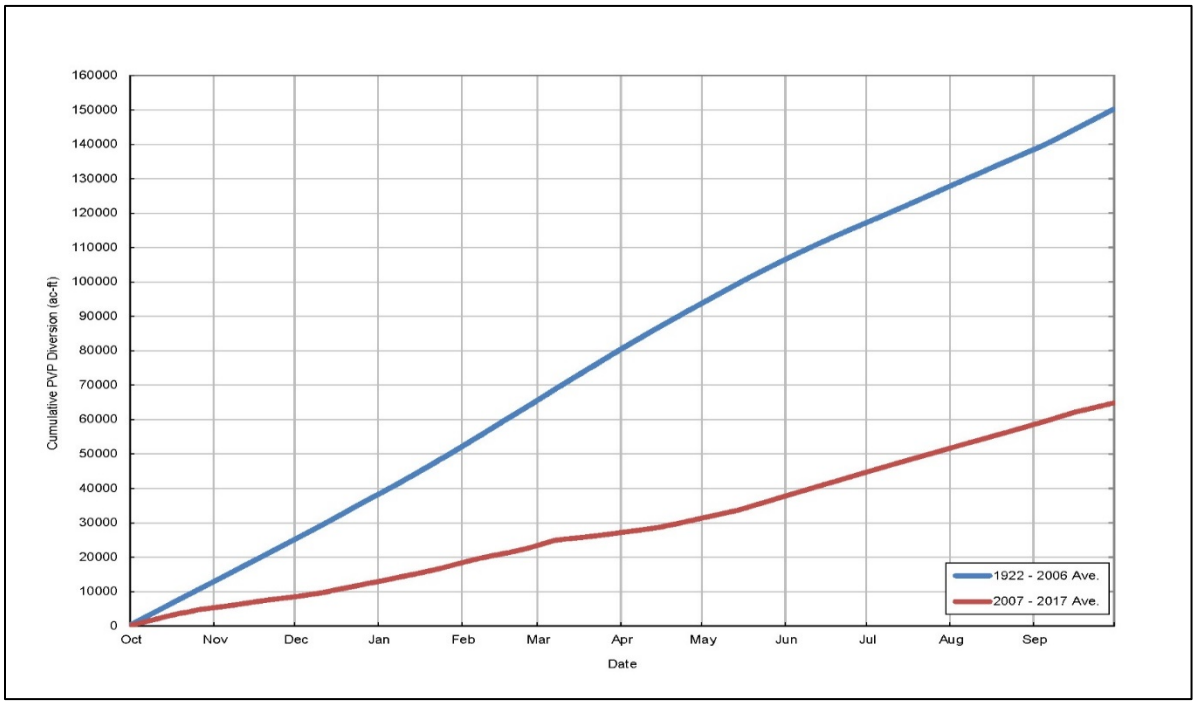

Figure 1. Cumulative Diversions of Eel River Water through the Potter Valley Project by Water Year

More importantly, a considerable portion of the reduced transfer occurs between March 1st and June 1st. As shown in Figure 2 below, the average transfer through PVP between March 1st and June 1st from 1922 through 2006 was approximately 40,000 acre-feet. From 2007 through 2017, the average transfer between March 1st and June 1st was slightly less than 15,000 acre-feet, a decrease of 63 percent.

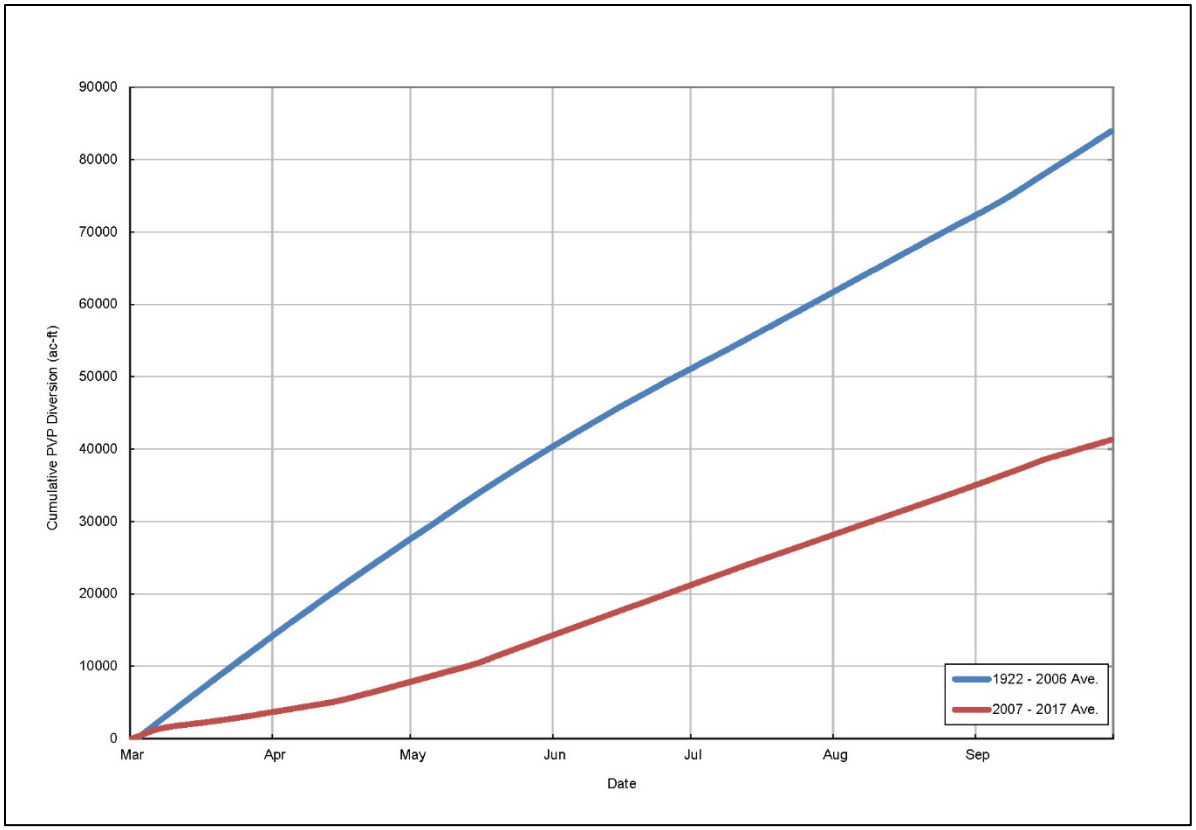

Figure 2. Cumulative Diversions of Eel River Water through the Potter Valley Project March 1 through September 30

This coincides with the time period that the water conservation pool begins increasing by 600 acre-feet per day, raising the water conservation pool from 68,400 acre-feet to 111,000 acre-feet. Consequently, Lake Mendocino has become reliant on late spring storm events to adequately fill in order to meet minimum instream flow requirements, downstream demands and maintain a cold-water pool for the fall Chinook salmon migration.

Because late spring storm events do not reliably occur, there have been a number of years since 2006 that Lake Mendocino has not had sufficient storage to meet water supply needs without risking draining the reservoir. As a result, the SCWA has needed to file Temporary Urgency Change Petitions with the State Water Resources Control Board in 2007, 2009, 2013, 2014 and 2015 to reduce minimum instream flow requirements in order to prevent draining Lake Mendocino.

PVP's FERC license expires in 2022 and PG&E has recently initiated the relicensing of PVP. Accordingly, if FERC issues a new operating license for the project, it could contain terms that further reduces the transfer of Eel River water in to the Russian River Watershed, resulting in even greater loss of water supply reliability of Lake Mendocino for the region. With the significant loss of water supply reliability, there is an urgent need to evaluate the operation of Lake Mendocino to determine if improvements can be implemented to offset reductions of Eel River transfers to the Russian River Watershed. This major deviation request is targeting the recovery of the compromised water supply reliability resulting from the changes to the PVP transfers from the Eel River. It is also requesting that tools developed as part of the Lake Mendocino FIRO project be included to inform USACE flood managers along with the protocols available to USACE for managing reservoir operations at Lake Mendocino.

In the summer of 2017, the FIRO Steering Committee completed the PVA which represents a major effort to develop the Lake Mendocino FIRO project, http://cw3e.ucsd.edu/firo-preliminary-viability-assessment-for-lake-mendocino/). This major body of work demonstrates that there is significant evidence that weather and water forecasts can be used to improve the operation of Lake Mendocino to recover water supply reliability without compromising flood management capacity. In addition, significant environmental benefits are achievable by improving fishery habitat for flows and water temperatures. These conclusions were reached through three independent studies conducted by the USACE's Hydrologic Engineering Center, Scripps Center for Western Weather and Water Extremes (CW3E), and the SCWA.

Description of Deviation Request

Members of the FIRO Steering Committee are requesting USACE approval of a planned major deviation to store additional water above the existing guide curve for the Coyote Valley Dam Lake Mendocino WCM within the shaded region shown in Figure 3. If approved, this would result in a maximum additional storage of 11,650 acre-feet between November 1 and February 28. Figure 3 below shows the existing guide curve for the Coyote Valley Dam Lake Mendocino WCM and the proposed guide curve with the requested changes. Table 1 provided in Appendix A summarizes the daily maximum deviation limit values.

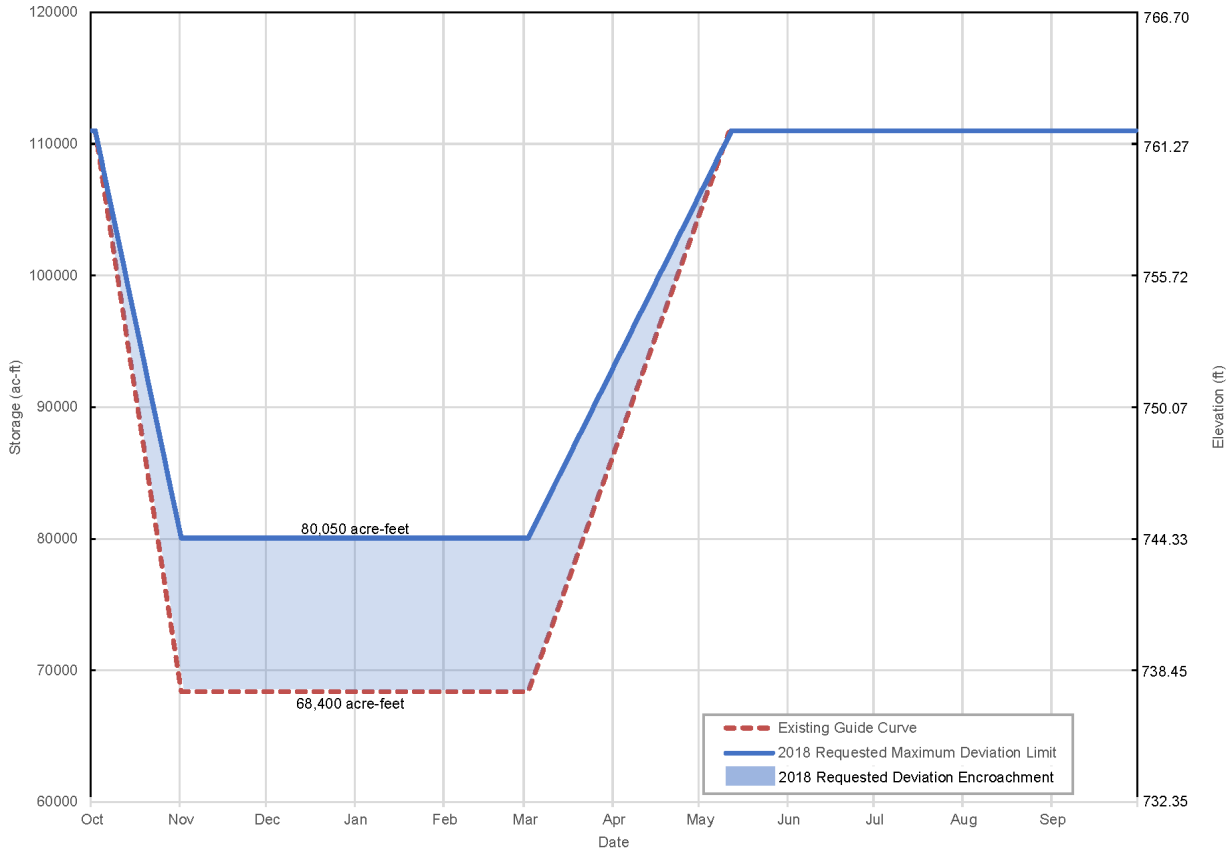

Figure 3. Existing Guide Curve and Proposed Guide Curve with Requested Changes.

As part of the planned major deviation, members of the FIRO Steering Committee are also requesting USACE include and leverage the DSM developed by the SCWA as part of the tools and protocols USACE

uses to manage reservoir operations at Lake Mendocino. Based on operational hydrologic ensemble of streamflow forecasts provided by the California-Nevada River Forecast Center, current reservoir storage, and current and anticipated downstream conditions, the DSM provides a recommended release to help inform operational decisions. The DSM is described in detail as "Hybrid Operations" in the PVA.
To test the DSM, the SCWA conducted a virtual operations test on a daily-basis from December 2016 to June 2017 simulating reservoir operations Lake Mendocino. This test demonstrated results consistent with the analysis completed for the PVA, showing improved water supply reliability over observed operations. Additionally, the results showed no increase in flood risk to downstream reaches in the Upper Russian River or increased dam safety risk. Figure 4 below shows the results of the virtual operations test using the DSM versus actual (observed) operation of Lake Mendocino during the 2017 winter season.

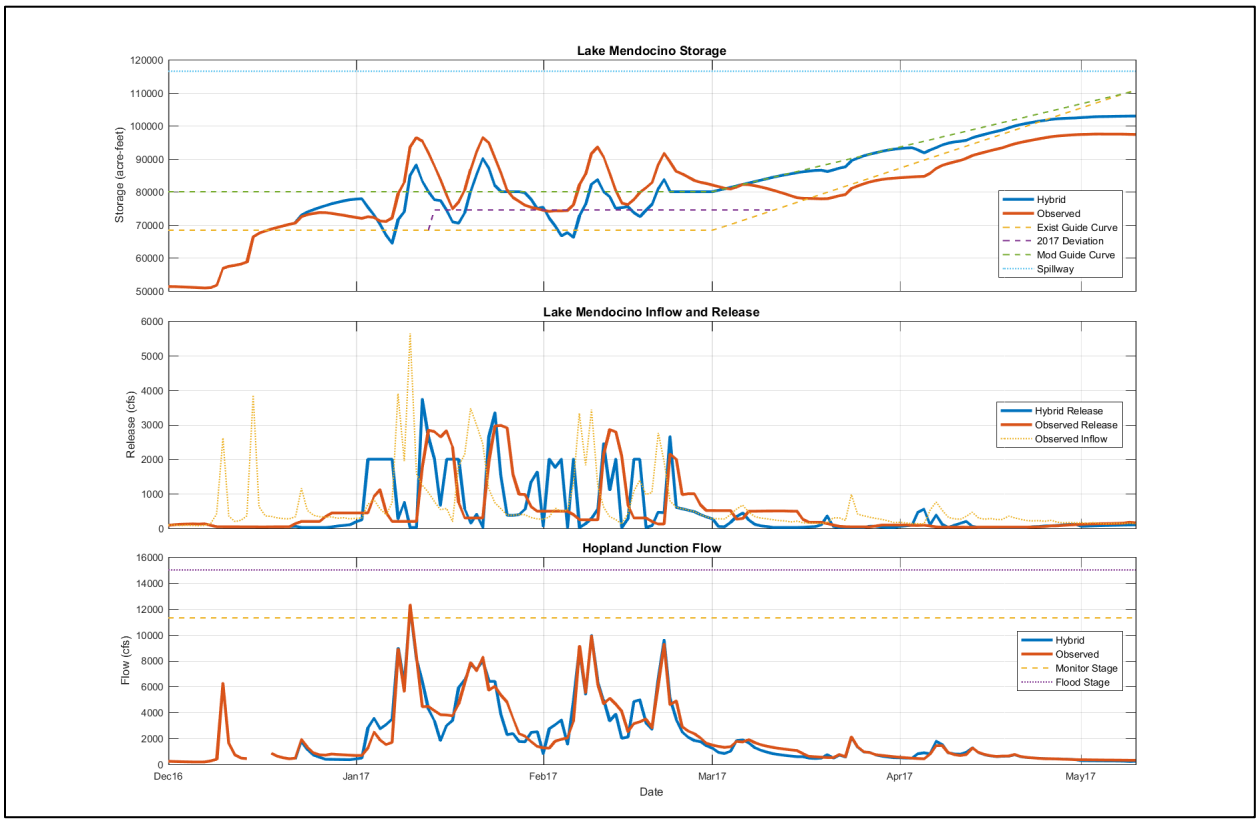

Figure 4. A comparison of Virtual Operations using the DSM with Actual Operations (observed) for December 2016 through May 2017

Although this demonstration covered only a (very wet) single season, several outcomes are noteworthy:

1. The peak reservoir storages for the virtual operations were lower than observed operations during the heart of the flood season suggesting an improved capacity to manage flood events;
2. Reservoir releases differed in timing, but the magnitude of the releases were comparable for both operations;
3. Simulated flows at Hopland above the 8,000 cfs flow constraint did not exceed observed operations; and
4. At the end of the mock operations test in May, simulated Lake Mendocino storage resulted in approximately 5,000 AF of additional stored water supply compared to observed operations.

Efforts are currently underway to develop a Russian River Decision Support System (RR-DSS), an additional tool to supplement USACE's spreadsheet and Corps Water Management System (CWMS) models, which will provide USACE operators with real time modeling and analysis to assist managing water retained in the flood control pool as requested by this major deviation. The RR-DSS will include an HEC-ResSim implementation as well as the SCWA DSM and is being modeled after the highly successful Yuba-Feather Forecast Coordinated Operations (FCO) interface that resides on California Data Exchange Center (CDEC) and is supported by the California Department of Water Resources (CA DWR). The Yuba-Feather FCO program is a 10-year collaboration between Yuba County Water Agency, DWR's State Water Project, and USACE's Sacramento District with support from NOAA that provides a common operating picture of the current and forecast weather and streamflow conditions from which improved reservoir regulation decisions can be made to better meet all partners' objectives. Consistent with FIRO project goals, the RR-DSS will be available to the project team to aid in identifying opportunities for refinement and improvement. As with all Lake Mendocino FIRO components, the Russian River DSS is being designed, developed and deployed by the interagency FIRO team.

FIRO Steering Committee Evaluation Process

This planned major deviation is part of a long-term effort leading to an anticipated WCM update. The flowchart provided in Figure 5 describes the process that members of the FIRO Steering Committee will pursue to further evaluate FIRO alternatives and pursue changes to the Lake Mendocino WCM. In the process of developing a FIRO strategy for Lake Mendocino, the project team has learned a great deal and expects to continue learning about how to improve operations for this project using the latest technology. Members of the FIRO Steering Committee intend to continue to request major deviations of the Lake Mendocino rule curve for the next few years and likely incorporate future iterations of FIRO decision support tools which include improved: 1) watershed and atmospheric observations; 2) atmospheric and hydrologic forecasts; and 3) modeling applications. As shown in Figure 5, upon conclusion of the deviation in the spring/summer season, the FIRO Steering Committee and USACE reservoir operators will consult and evaluate whether any modifications to the prior year deviation should be made to further optimize operations. A new deviation request will be made the subsequent year to include improvements developed from the previous year. This process is anticipated to result in a future request to update the WCM.

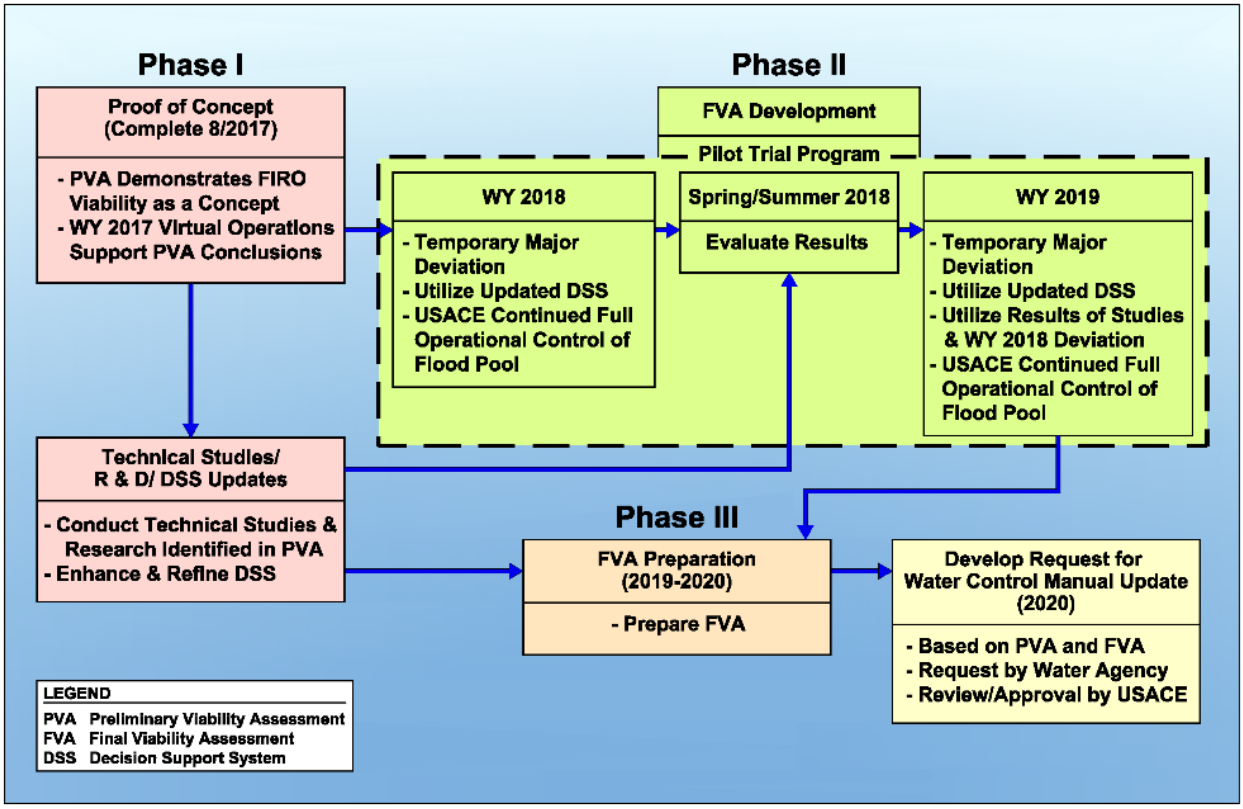

Figure 5. Process diagram for FIRO implementation at Lake Mendocino.

Appendix A

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	111,000	80,050	80,050	80,050	80,050	80,050	93,127	106,205	111,000	111,000	111,000	111,000
2	111,000	80,050	80,050	80,050	80,050	80,050	93,563	106,641	111,000	111,000	111,000	111,000
3	109,968	80,050	80,050	80,050	80,050	80,486	93,999	107,077	111,000	111,000	111,000	111,000
4	108,937	80,050	80,050	80,050	80,050	80,922	94,435	107,513	111,000	111,000	111,000	111,000
5	107,905	80,050	80,050	80,050	80,050	81,358	94,871	107,949	111,000	111,000	111,000	111,000
6	106,873	80,050	80,050	80,050	80,050	81,794	95,307	108,385	111,000	111,000	111,000	111,000
7	105,842	80,050	80,050	80,050	80,050	82,230	95,743	108,820	111,000	111,000	111,000	111,000
8	104,810	80,050	80,050	80,050	80,050	82,665	96,179	109,256	111,000	111,000	111,000	111,000
9	103,778	80,050	80,050	80,050	80,050	83,101	96,615	109,692	111,000	111,000	111,000	111,000
10	102,747	80,050	80,050	80,050	80,050	83,537	97,051	110,128	111,000	111,000	111,000	111,000
11	101,715	80,050	80,050	80,050	80,050	83,973	97,487	110,564	111,000	111,000	111,000	111,000
12	100,683	80,050	80,050	80,050	80,050	84,409	97,923	111,000	111,000	111,000	111,000	111,000
13	99,652	80,050	80,050	80,050	80,050	84,845	98,358	111,000	111,000	111,000	111,000	111,000
14	98,620	80,050	80,050	80,050	80,050	85,281	98,794	111,000	111,000	111,000	111,000	111,000
15	97,588	80,050	80,050	80,050	80,050	85,717	99,230	111,000	111,000	111,000	111,000	111,000
16	96,557	80,050	80,050	80,050	80,050	86,153	99,666	111,000	111,000	111,000	111,000	111,000
17	95,525	80,050	80,050	80,050	80,050	86,589	100,102	111,000	111,000	111,000	111,000	111,000
18	94,493	80,050	80,050	80,050	80,050	87,025	100,538	111,000	111,000	111,000	111,000	111,000
19	93,462	80,050	80,050	80,050	80,050	87,461	100,974	111,000	111,000	111,000	111,000	111,000
20	92,430	80,050	80,050	80,050	80,050	87,896	101,410	111,000	111,000	111,000	111,000	111,000
21	91,398	80,050	80,050	80,050	80,050	88,332	101,846	111,000	111,000	111,000	111,000	111,000
22	90,367	80,050	80,050	80,050	80,050	88,768	102,282	111,000	111,000	111,000	111,000	111,000
23	89,335	80,050	80,050	80,050	80,050	89,204	102,718	111,000	111,000	111,000	111,000	111,000
24	88,303	80,050	80,050	80,050	80,050	89,640	103,154	111,000	111,000	111,000	111,000	111,000
25	87,272	80,050	80,050	80,050	80,050	90,076	103,589	111,000	111,000	111,000	111,000	111,000
26	86,240	80,050	80,050	80,050	80,050	90,512	104,025	111,000	111,000	111,000	111,000	111,000
27	85,208	80,050	80,050	80,050	80,050	90,948	104,461	111,000	111,000	111,000	111,000	111,000
28	84,177	80,050	80,050	80,050	80,050	91,384	104,897	111,000	111,000	111,000	111,000	111,000
29	83,145	80,050	80,050	80,050		91,820	105,333	111,000	111,000	111,000	111,000	111,000
30	82,113	80,050	80,050	80,050		92,256	105,769	111,000	111,000	111,000	111,000	111,000
31	81,082		80,050	80,050		92,692		111,000		111,000	111,000	

Table 1. Coyote Valley Dam - Lake Mendocino Maximum Daily Deviation Limit Values (acre-feet)