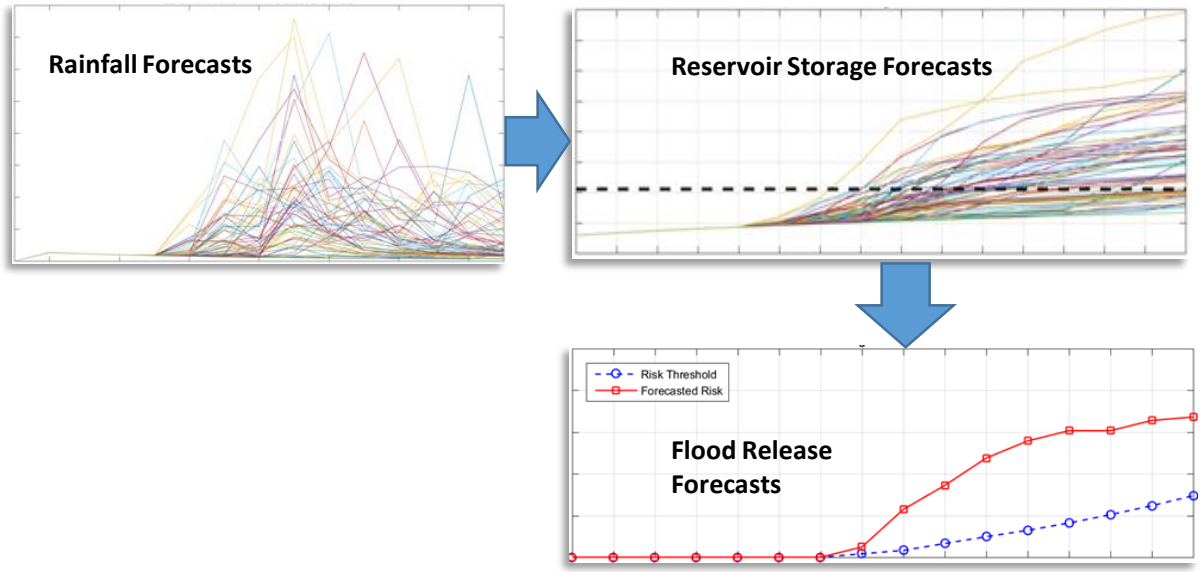
Final Viability Assessment Preview & Results of WY 2020 Interim Operations

Lake Mendocino Demonstration Project

Lake Mendocino 2014



7th Annual FIRO Workshop
August 4, 2020

Jay Jasperse, P.E.
Chief Engineer/Director Groundwater Management
Sonoma Water

Sonoma Water

Overview of Presentation

- Background/Context
- Project Timeline
- Interim Operations – WY 2020 Review
- Evaluation of FIRO Water Control Plan alternatives
- Recommendations
- Next Steps

Background - Regional Setting

Russian River Watershed

Lake Sonoma

Lake Mendocino

Russian River

Lake Mendocino

- Water Supply Pool 68,400 AF (SW)
- Flood Pool 48,100 AF (USACE)

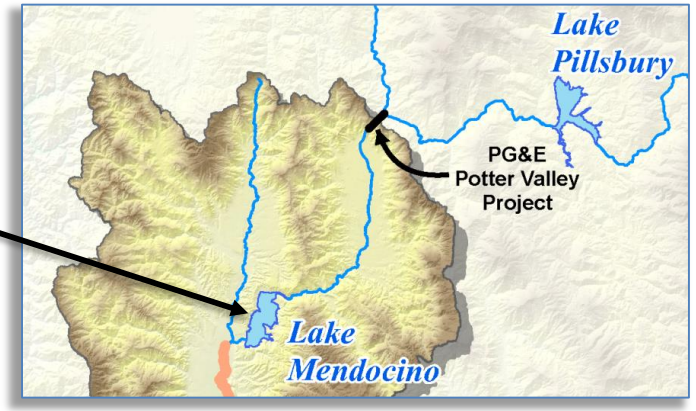
Lake Sonoma

- Water Supply Pool 245,000 AF (SW)
- Flood Pool 136,000 AF (USACE)

Regional Benefits

- Flood Risk Management
- Potable Water Supply
- Agriculture Irrigation
- Ecosystem Services
- Tourism & Recreation

Russian River Reservoirs



- Coyote Valley Dam
  - Constructed by USACE in 1959
  - USACE: Flood Control Operations
  - SCWA: Water Supply Operations
- Watershed Area 105 mi2
- Maximum Water Supply: 111,000 acre-feet
- Potter Valley Project – PG&E
  - Imports water from Eel River in the East Fork Russian River

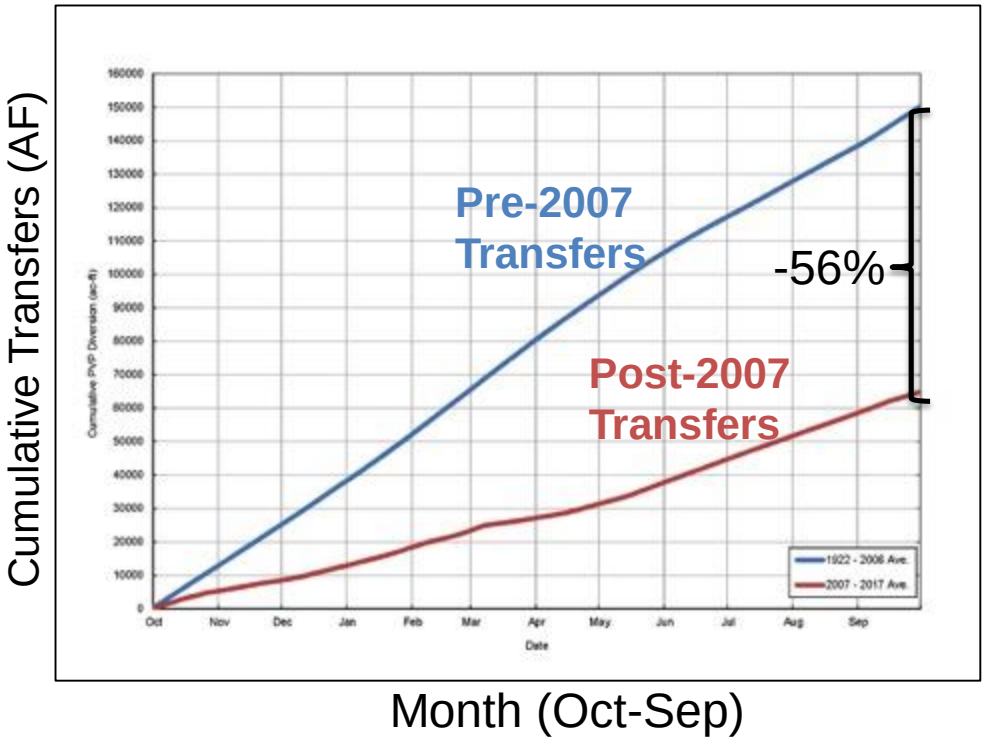
Reduced Inflows to Lake Mendocino

Post-2007 reductions (56%) in transfers from the Eel River.

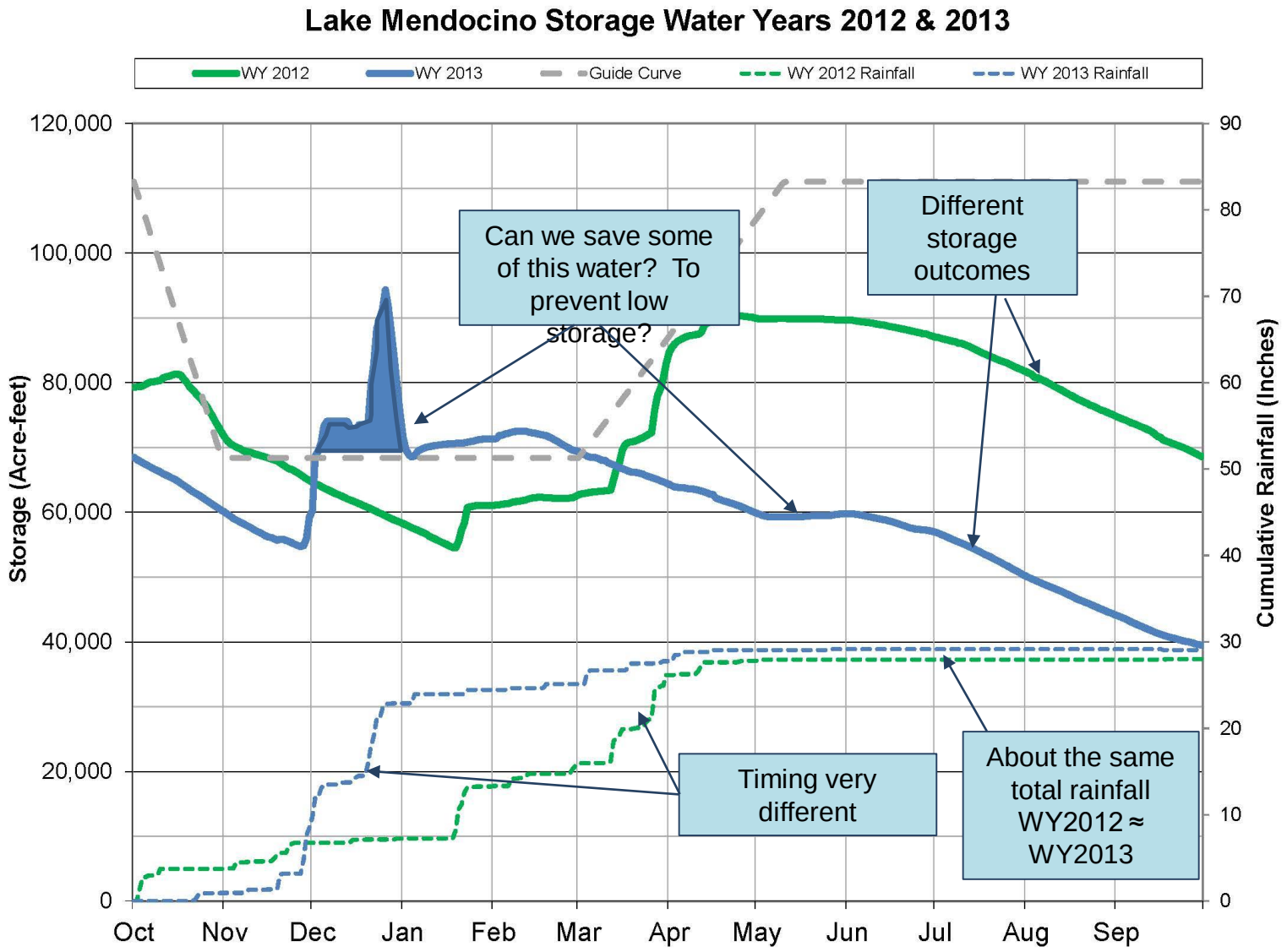
Dramatically reduced ability of reservoir to provide reliable water supply for municipal, agricultural, and ecosystems needs.

Overall average reduction of 45% <u>total</u> inflows into reservoir.

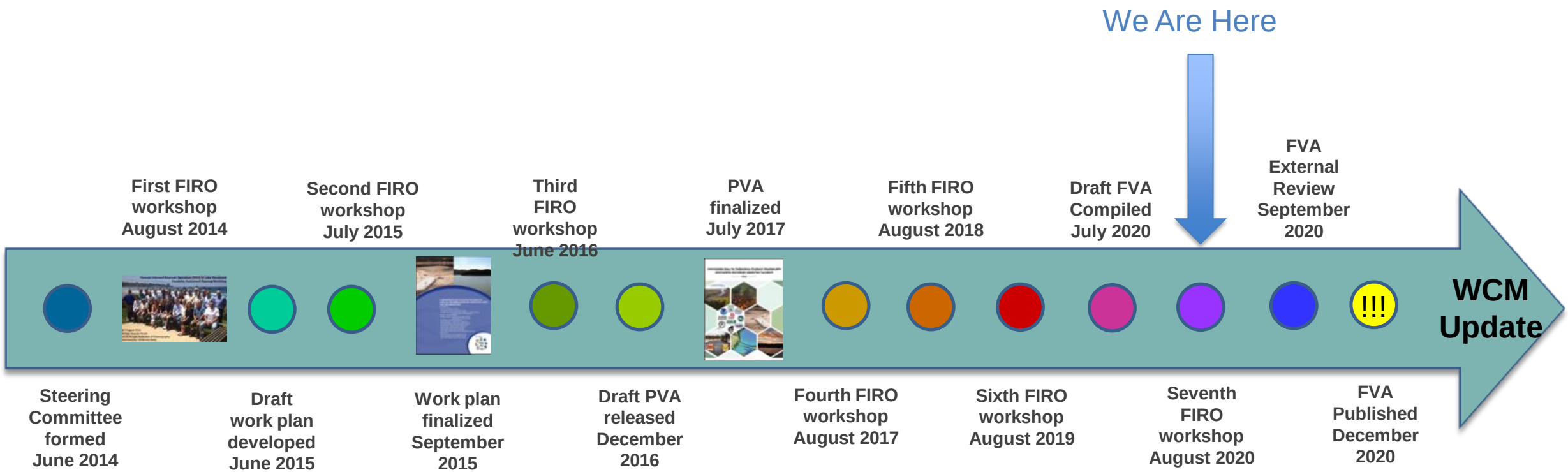
Future Eel River transfer reductions possible due to FERC re-licensing or decommissioning



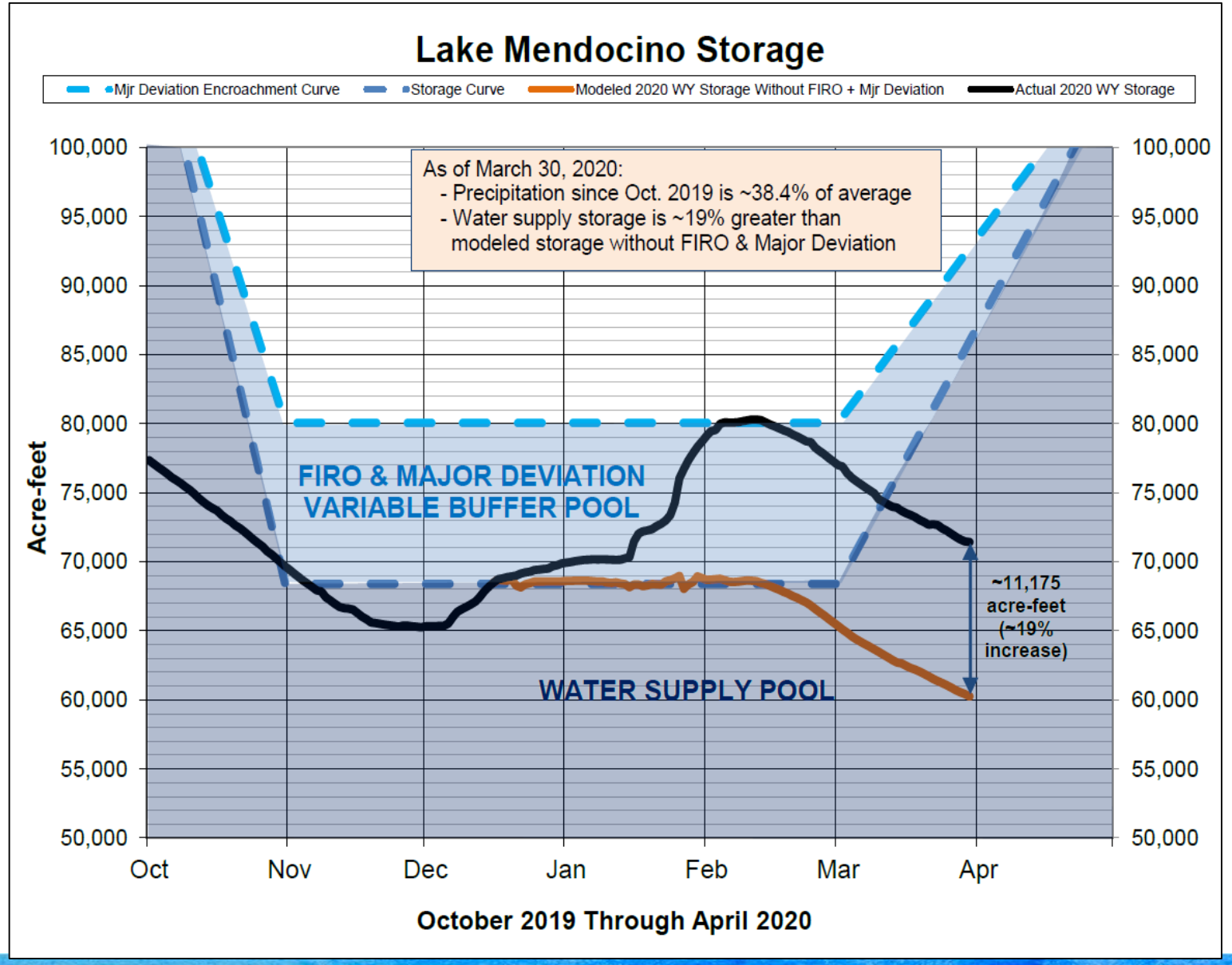
Lake Mendocino– Water Years 2012 &2013



Lake Mendocino FIRO Timeline 2014-2020



Lake Mendocino – Major Deviation WY 2020



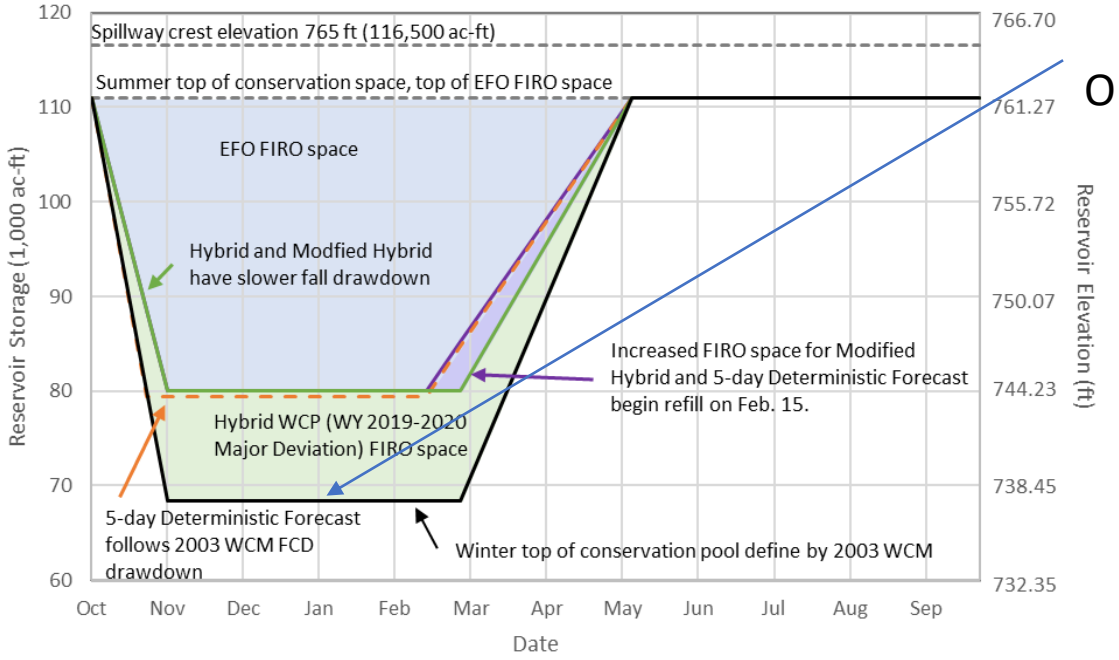
Hydrologic Engineering Plan for the Evaluation of FIRO WCP Alternatives (A Component of the FVA)

- Provides a “level playing field” to evaluate alternative performance relative to current operations
- Adheres to policies & regulations
- Identifies operational constraints
- Develops quantitative metrics
- Evaluates FIRO alternatives relative to current WCM operations
- Formal simulation and evaluation process
- Participant roles and responsibilities
- Multi-agency team conducted extensive analyses, oversight by Steering Committee
- Effort began in March 2019, completed in June 2020

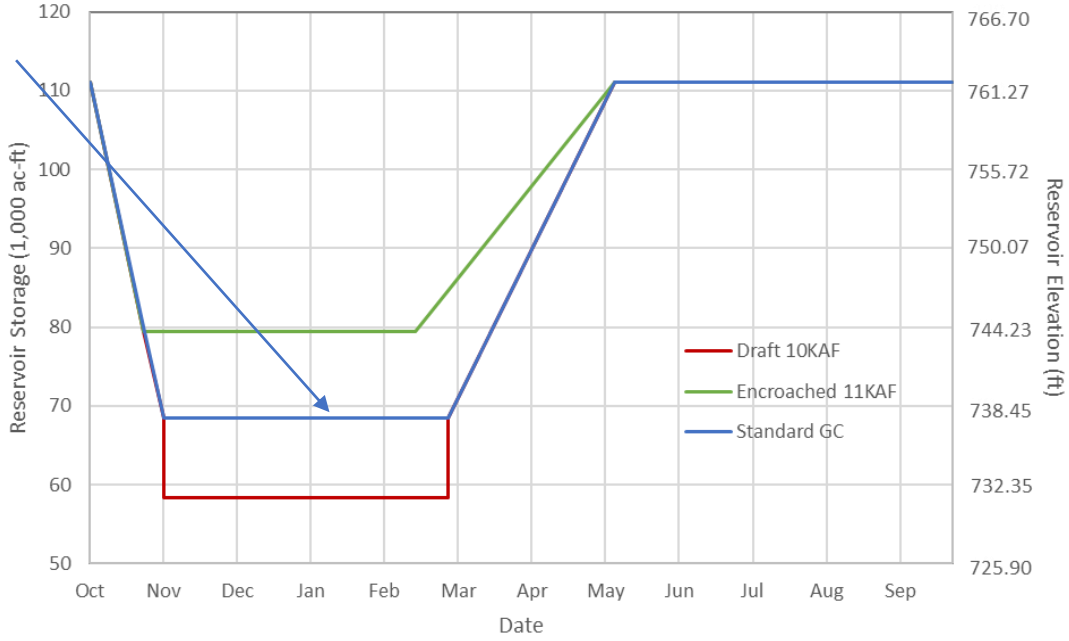
FIRO Water Control Plan (WCP) Alternatives

ID (1)	WCP alternative (2)	Description (3)
1	Existing WCP operation (Baseline)	Includes the seasonal rule curve and release selection rules from the 1986 USACE WCM and 2003 update to the flood control diagram (FCD).
2	Ensemble Forecast Operations (EFO)	Operates without a traditional rule curve and uses the 15-day ensemble streamflow forecasts to identify required flood releases.
3	Hybrid	A combination of the Baseline WCP and the EFO. This WCP was used for Major Deviation Operations in WY19 and WY20.
4	Modified Hybrid	Identical to Hybrid but with a “corner cutting” strategy that allows for greater storage to begin February 15th to aid with spring refill.
5	5-day deterministic forecast	Defines alternative guide curves with 11,000 AF encroachment space and 10,000 draft space above and below the Baseline guide curve. Uses 5-day deterministic inflow (and Hopland) forecasts to choose the guide curve and make release decisions.

FIRO WCP Alternatives – Guide Curves



Existing Operations



EFO, Modifed Hybrid EFO, Hybrid EFO

Deterministic 5-day

Evaluation Metrics

Metric (1)	Metric Description (2)
M1	Annual maximum flow frequency function at Hopland, Healdsburg, and Guerneville
M2	Annual maximum pool elevation frequency function of Lake Mendocino
M3	Annual maximum pool elevation frequency function of Lake Sonoma
M4	Annual maximum Lake Mendocino total release frequency function
M5	Annual maximum Lake Sonoma total release frequency function
M6	Annual maximum uncontrolled spill frequency function for Lake Mendocino
M7	Annual maximum uncontrolled spill frequency function for Lake Sonoma
M8	Expected annual inundation damage (EAD) at critical Russian River locations
M9	Expected annual potential (statistical) loss of life due to floodplain inundation, critical Russian River locations (assessed as “population exposed” (EAP))
M10	Reliability of water supply delivery, as measured by annual exceedance frequency of Lake Mendocino May 10 reservoir storage levels
M11	The ability to meet instream flows to support threatened and endangered fish during the summer rearing season, as measured by the annual exceedance of the number of days June through September flows exceed 125 cfs
M12	The ability to meet instream flows to support fall spawning migration, as measured by the annual exceedance of the number of days October 15 to January 1 flows exceed 105 cfs
M13	Impacts to the Bushay Campground during the rec season (Memorial Day through Labor Day), as measured by the annual exceedance of the number of days that Lake Mendocino water-surface elevation exceeds 750 ft (elevation of access road).
M14	Impacts to power production of the CVD powerhouse
M15	Lake Mendocino bank protection, as measured by annual frequency of exceeding elevation 758.8 ft. (Later refined to capture the number of days above 758.8 ft.)
M16	Impacts to hours of operation (As measured by the number of required gate changes).

Flood Risk Management

Environmental (Fisheries)

Hydropower Production

Operations Workload

Water Supply Reliability

Recreation

Dam Safety (bank protection)

Simulation Plan

- Simulation based on hindcasts of inflows and locals from CNRFC
  - 60-member ensemble
  - 15-day duration (forecast), hourly timestep
- Period of Record – 32 years (1985-2017)
- Scaled events
  - 200-year and 500-year 3-day volume
  - Feb ‘86, Mar ‘95, Jan ‘97, Jan ’06
- Robustness testing
  - 200-year 18-day back-to-back event Dec ‘05 – Jan ‘06

Results - Comparison of Metrics

- Alternative ranking methods (nearly same)
  - Objective
  - Expert elicitation (shown here)
- Rankings
  - Most effective = 1 (green)
  - Least effective = 5 (red)
- All FIRO WCP alternatives were judged better than the existing WCM operations
- No impacts on Lake Sonoma operations (M3, M5, M7)
- Modified Hybrid EFO model provided the most effective balanced results given project objective

Average votes of WCP alt by flood risk management metrics

Metric ID	Baseline	EFO	Hybrid	Modified Hybrid	5-day Deterministic Forecast
M1	4.1	1.6	1.5	1.4	2.2
M2	4.6	2.9	1.5	1.5	2.9
M4	4.7	2.6	1.3	1.1	2.9
M6	4.7	2.9	1.3	1.1	2.9
M8	3.6	2.1	1.3	1.3	2.2
M9	3.6	1.8	1.2	1.3	2.0
Average	**4.3**	**2.3**	**1.3**	**1.2**	**2.5**

Average votes of WCP alt by water supply and environmental metrics

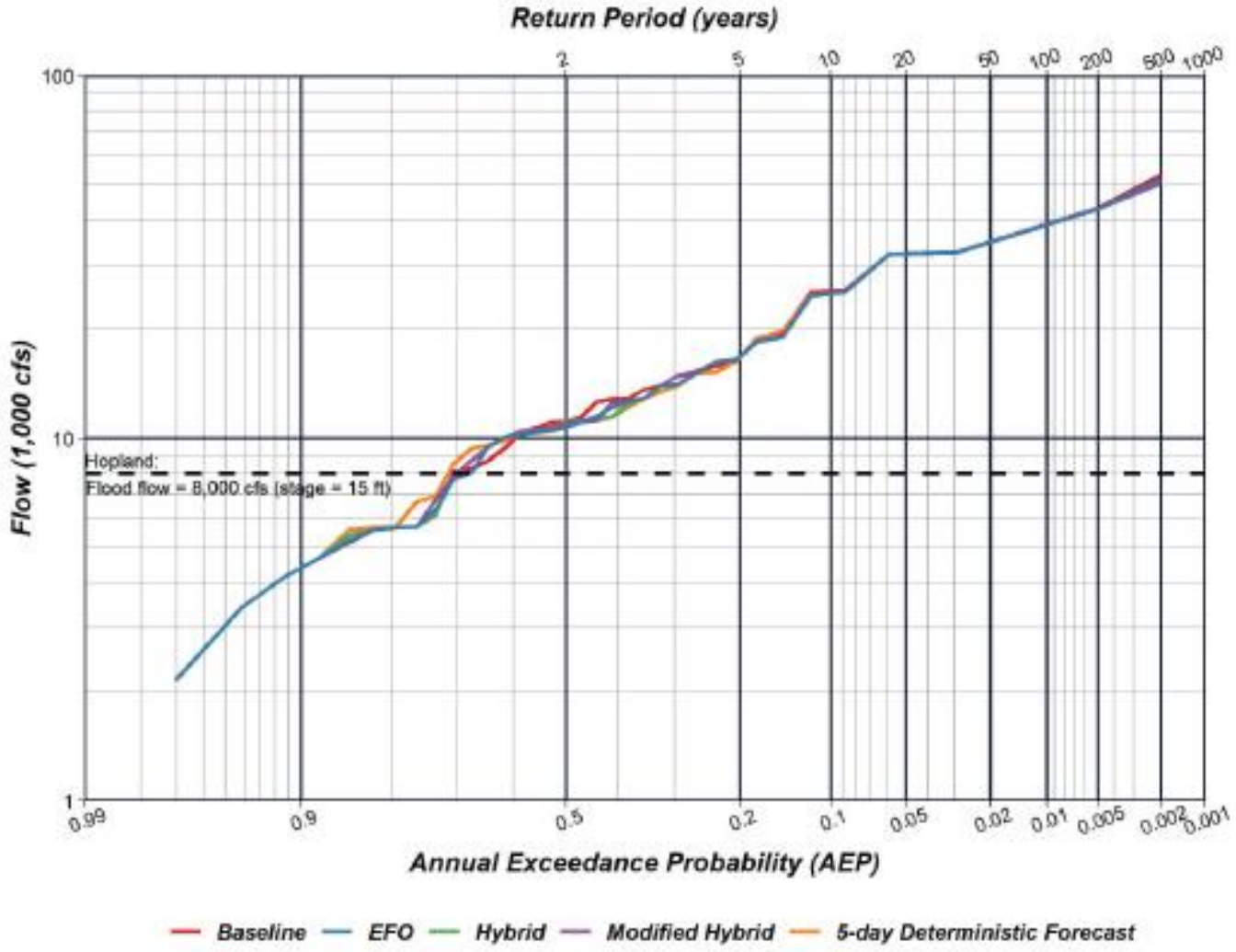
Metric ID	Baseline	EFO	Hybrid	Modified Hybrid	5-day Deterministic Forecast
M10	5.0	1.0	2.7	2.1	2.6
M11	4.8	1.1	2.3	2.3	2.3
M12	4.9	1.3	2.5	2.3	2.3
Average	**4.9**	**1.1**	**2.5**	**2.2**	**2.4**

Average votes of WCP alt by recreation, power, dam safety, and operations metrics

Metric ID	Baseline	EFO	Hybrid	Modified Hybrid	5-day Deterministic Forecast
M13	1.3	4.7	2.8	3.1	2.8
M14	1.7	4.1	1.6	1.8	1.4
M15	1.4	4.6	2.1	1.9	2.5
M16	2.4	1.1	2.8	2.9	4.3
Average	**1.7**	**3.6**	**2.3**	**2.4**	**2.8**

M1 – Annual maximum flow exceedance probability at Hopland*

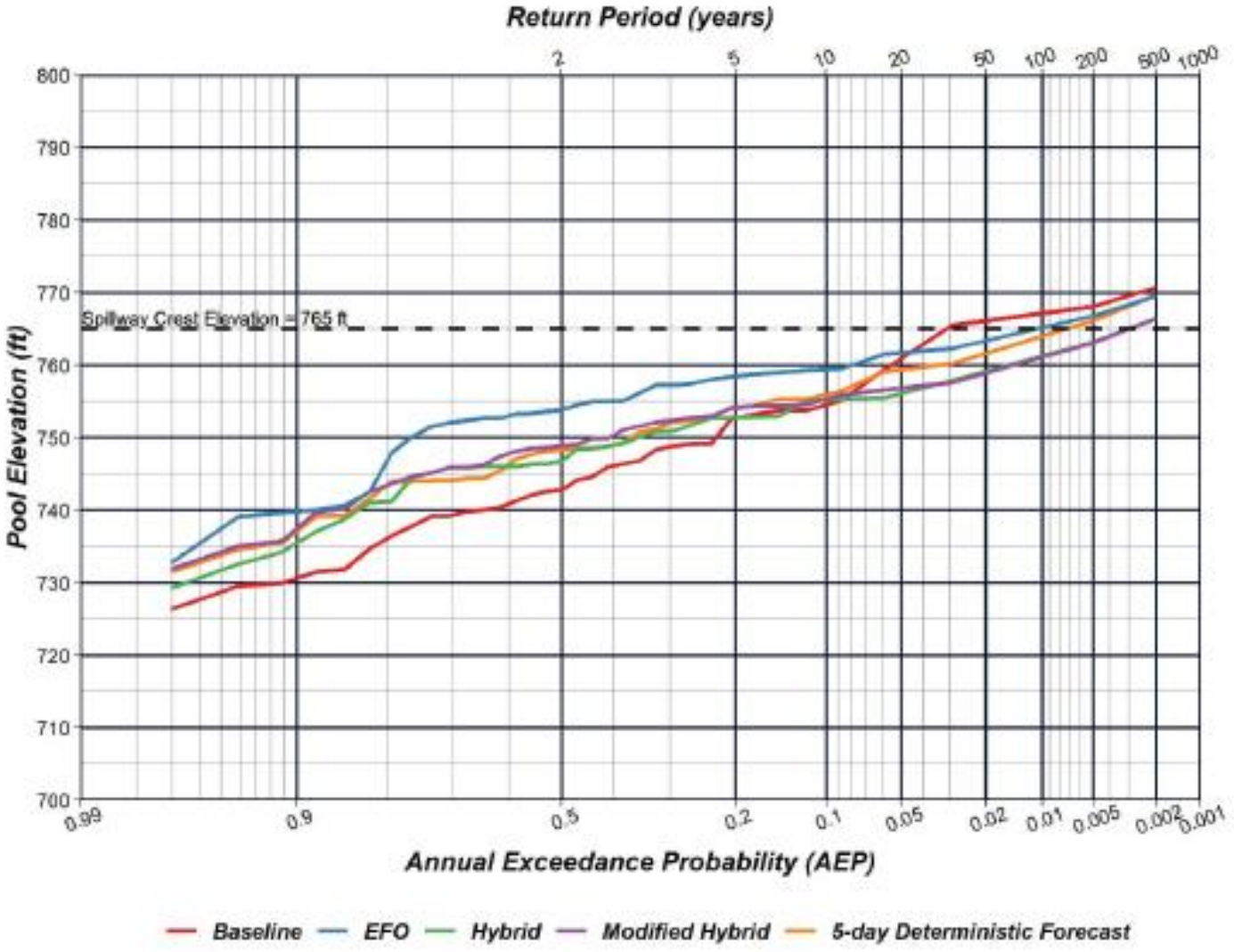
- No significant difference in annual maximum flow frequency at Hopland



* Also evaluated at Healdsburg and Guerneville (even smaller differences downstream

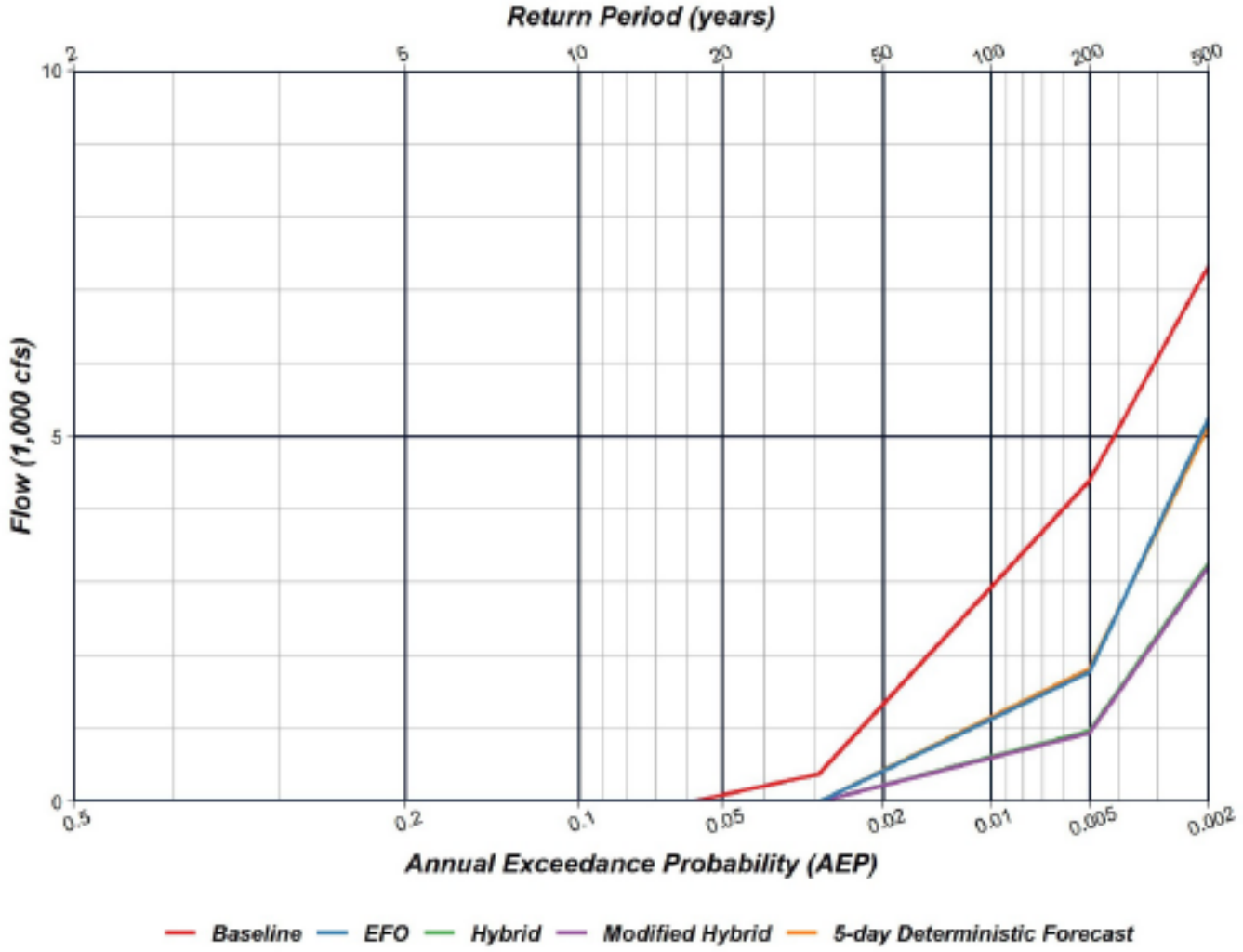
M2 – Annual maximum pool elevation-frequency in Lake Mendocino

- FIRO WCP alternatives are higher for dry to moderate years but lower in extremely wet years



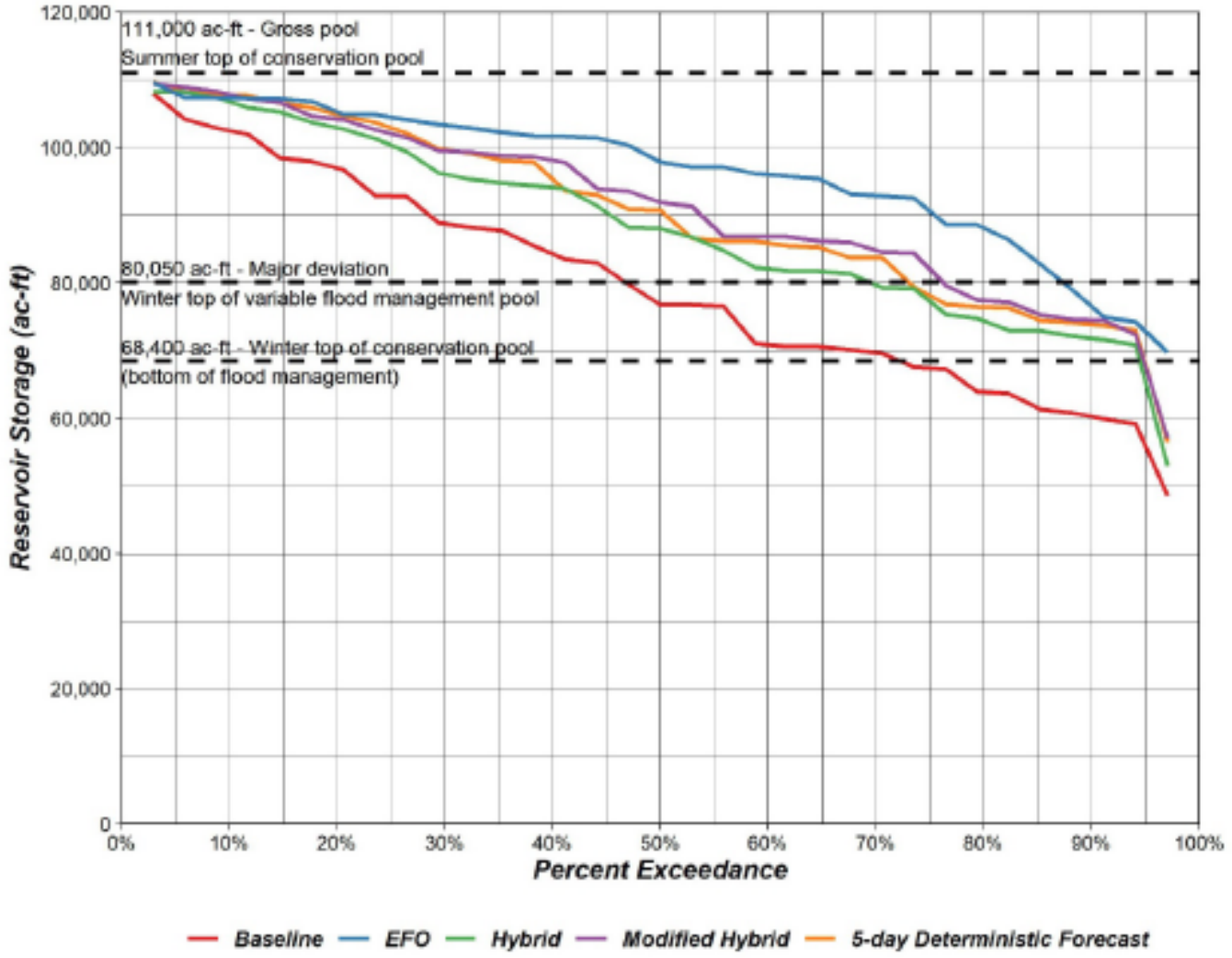
M6 – Annual maximum uncontrolled spill-frequency in Lake Mendocino

- All FIRO WCP alternatives reduce uncontrolled spill for extreme events
- Hybrid and Modified Hybrid are most effective



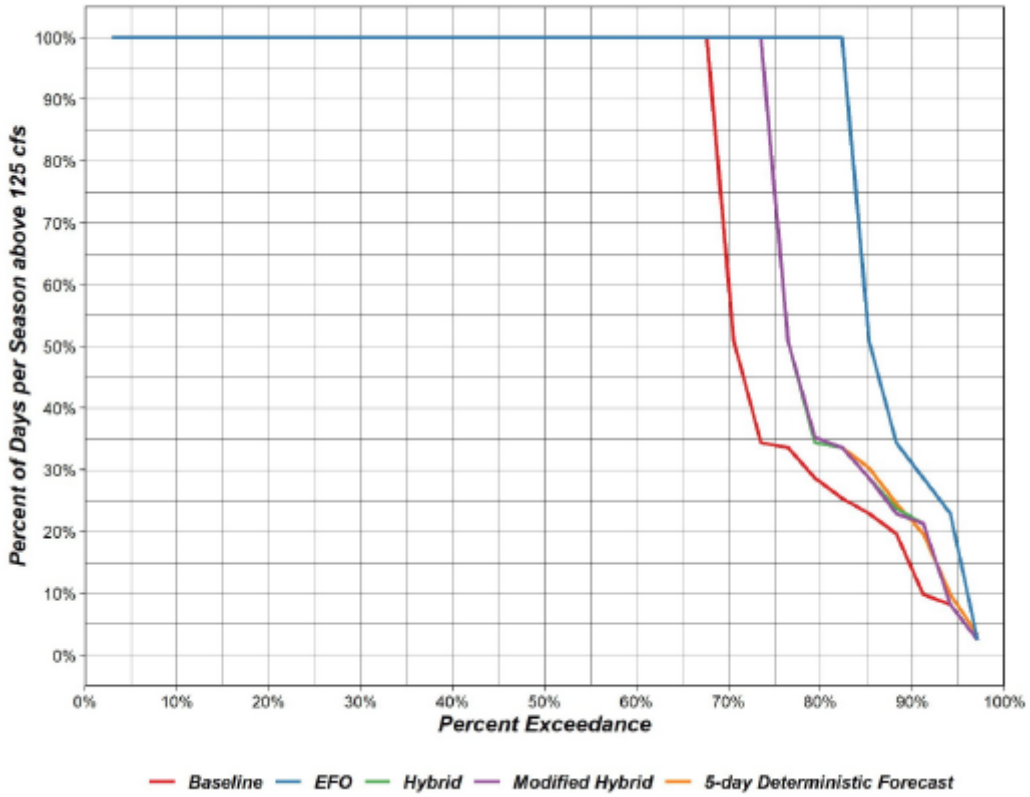
M10 – Annual exceedance probability of Lake Mendocino storage on May

- EFO is consistently higher
- Existing operations is consistently lower
- Other 3 FIRO WCPs are in between w/ Modified Hybrid a bit higher



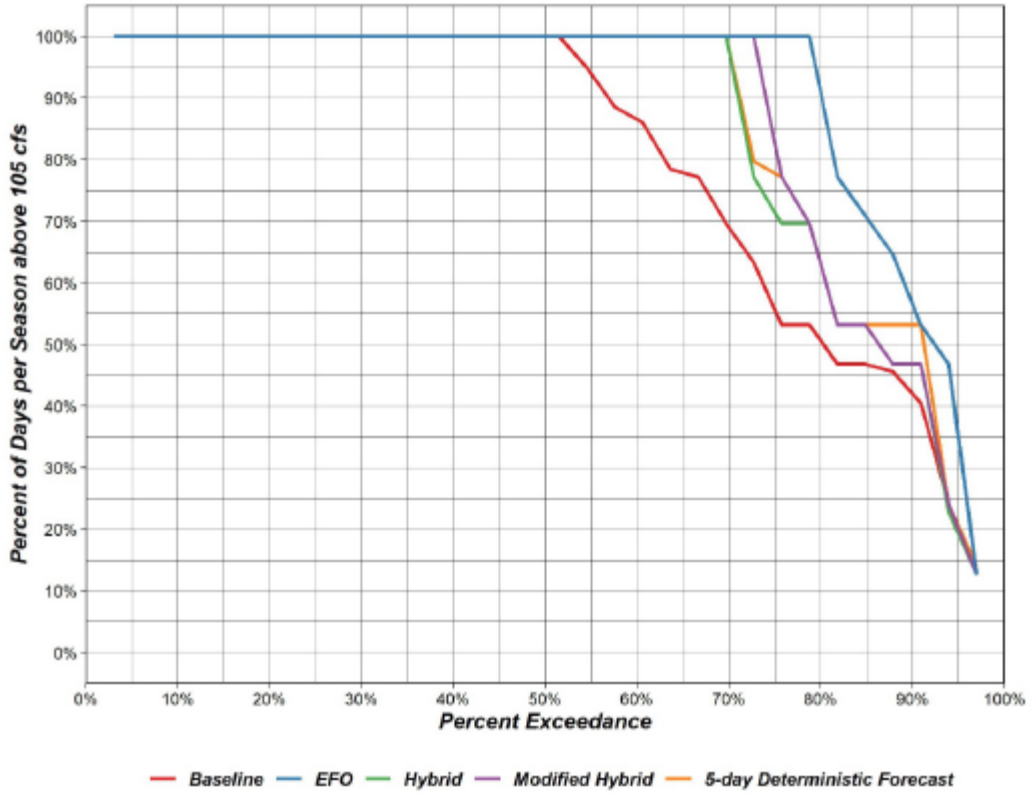
M11 & M12 – Support for Fisheries Flows

Rearing



Percent of days per season, June-September, in which flows exceed 125 cfs at Hopland

Fall Spawning



Percent of days per season, October 12 through January 1, in which flows exceed 105 cfs at East-West Junction

Steering Committee Recommendations

- Pursue WCM update
  - Initial WCP = Modified Hybrid EFO
  - “FIRO Space” as a strategy for leveraging future forecast skill improvement
- Continue decision support services
- Enhance HEC toolset to better evaluate ensemble-based WCPs
- Continue enhanced observation efforts
- Continue research efforts
- Request 5-year deviation while WCM is in update process
- Expand pathways for Research to Operations (R2O)
- Pivot efforts to investigate FIRO for Lake Sonoma

Next Steps

- FVA external panel review – September 2020
- Request major deviation for water years 2021-2025
- Publish FVA – December 2020
- Pursue WCM Update
- Retain Steering Committee
  - Continue research activities
  - Development of forecast skill metrics to trigger expanded FIRO capacity as part of “adaptive” water control manual concept