

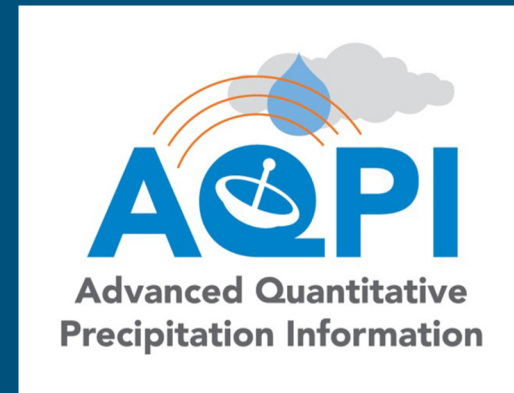
# AQPI Data Implementation Working Group (DIWG)



Forecast Informed Reservoir Operations (FIRO) Using Ensemble Streamflow Prediction for Lake Mendicino- Chris Delaney, SCWA

NWM Slack Channel Feedback & Bay Area Calibration Basins -Dave Gochis, NCAR

Marin Flash Flood Forecast Formula Tool - Roger Leventhal, MCFC



Monthly meeting - Sept 23, 2020

NOAA Research, NOAA NWS

Network of Bay Area Water Agency Users, USGS CoSM



**Sonoma  
Water**

# Forecast Informed Reservoir Operations Using Ensemble Streamflow Prediction for Lake Mendocino

**September 23, 2020**

**Chris Delaney<sup>1</sup>**

Jay Jasperse<sup>1</sup>

John Mendoza<sup>1</sup>

F. Martin Ralph<sup>2</sup>

Robert Hartman<sup>3</sup>

Cary Talbot<sup>4</sup>

1. Sonoma Water
2. Scripps Institution of Oceanography
3. Robert Hartman Consulting
4. U.S. Army Corps of Engineers



# Presentation Overview

- Background
- Lake Mendocino Model
- Preliminary Viability Assessment Results
- 2019 & 2020 Major Deviations
- Next Steps

# Forecast Informed Reservoir Operations

## Lake Mendocino FIRO Demonstration Project

### ❖ Objective

- Improve water supply reliability, yet
- Not increase flood risk to downstream communities.

### ❖ Steering Committee

- County, State and Federal Agencies
- Co-Chairs:
  - Jay Jasperse, Sonoma Water
  - F. Martin Ralph, Center for Western Weather & Water Extremes (CW3E)

### ❖ Preliminary Viability Assessment - Summer 2017

### ❖ Water Resources Research Publication - September 2020



Sonoma Water



US Army Corps  
of Engineers®



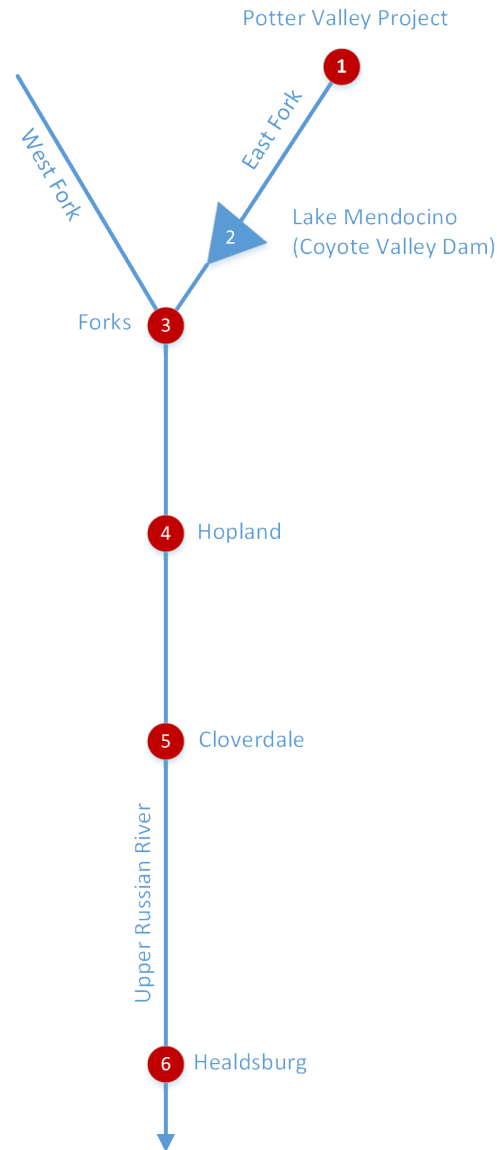
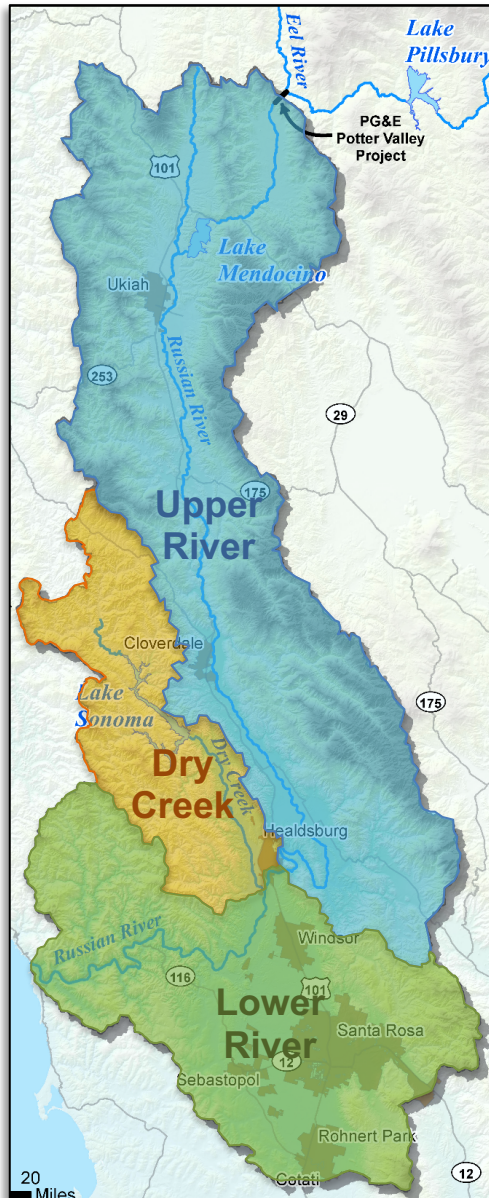
# Lake Mendocino

- ❖ Upper Russian River Watershed
- ❖ Coyote Valley Dam
  - Constructed by the Army Corps of Engineers in 1959
  - USACE: Flood Control
  - Sonoma Water: Water Supply
- ❖ Watershed Area: 105 mi<sup>2</sup>
- ❖ Max Water Supply: 111,000 acre-feet



# Lake Mendocino

## Ensemble Forecast Operations Model



### ❖ Reservoir Management Model

- Developed in MatLab
- Hourly and Daily Time Step

### ❖ Upper Russian River

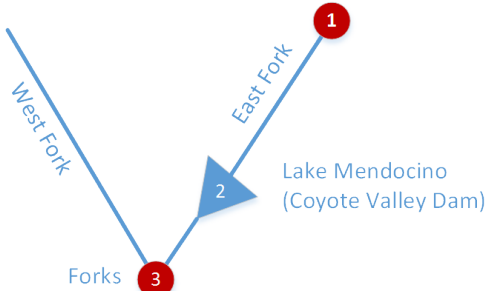
- Headwaters to the City of Healdsburg
- 70 mile reach
- 6 Model Junctions
  - USGS Discharge Gages
  - NOAA Flow Forecast Points

# Lake Mendocino Ensemble Forecast Operations Model

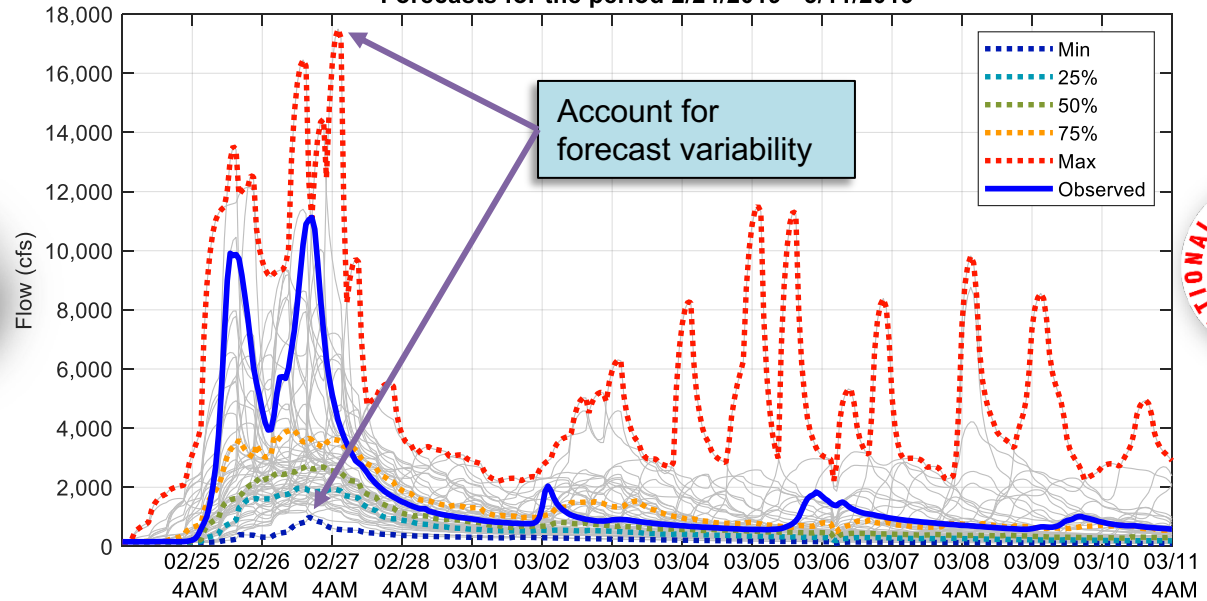
## CNRFC

### California Nevada River Forecast Center

Potter Valley Project



MEFP-based Traces for Russian R - Ukiah  
Forecasts for the period 2/24/2019 - 3/11/2019



## HEFS

### Hydrologic Ensemble Forecast System

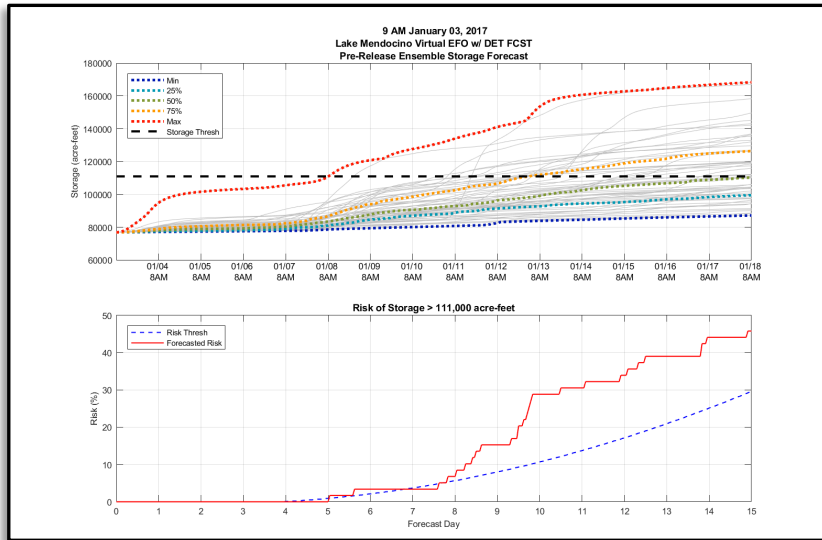
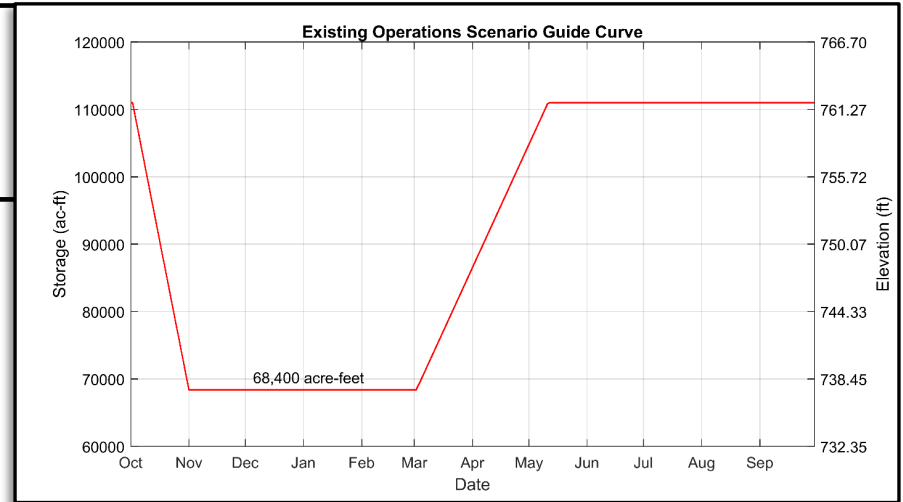
#### ❖ HEFS Hindcast

- Historical Conditions: 1985-2010
  - 61 member, 15-day

# 3 Model Scenarios

## 1. Existing Operations

➤ Current Storage Guide Curve

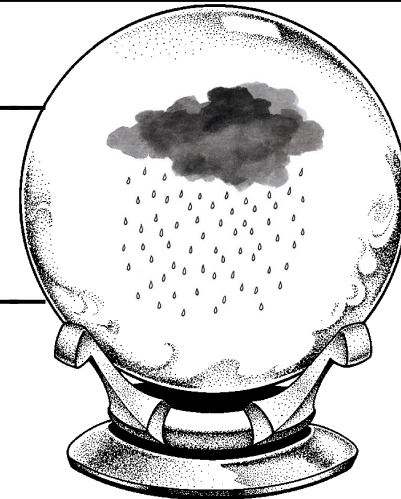


## 2. Ensemble Forecast Operations (EFO)

➤ Risk based approach

## 3. Perfect Forecast Operations

➤ Observed flows in place of hindcasted flows



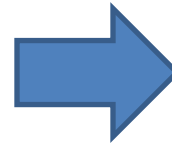
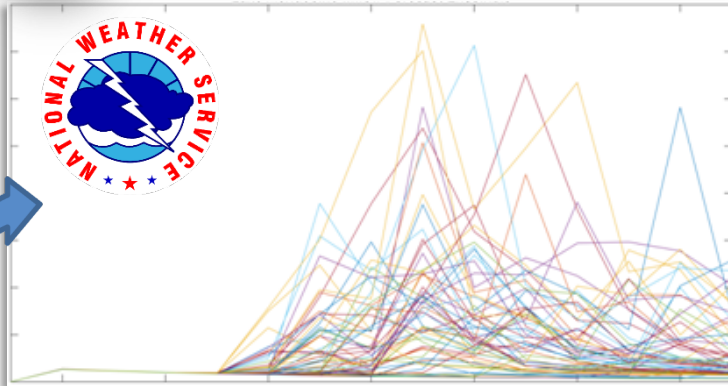
Sanoma  
Water



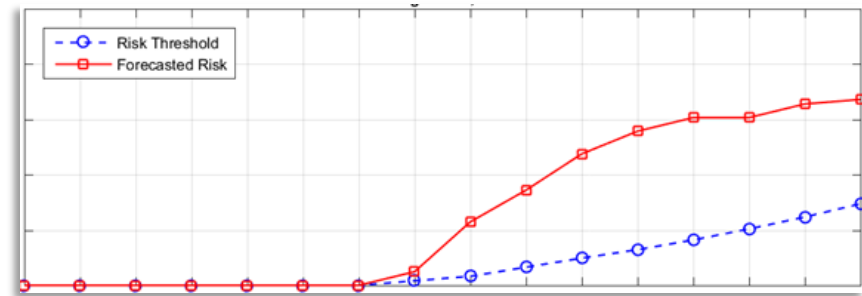
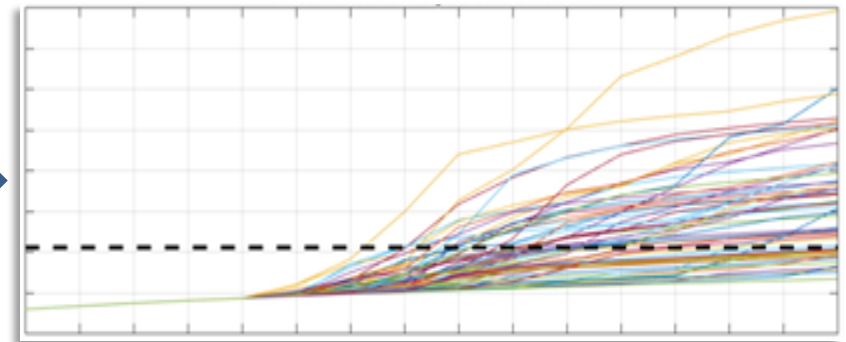
# Ensemble Forecast Operations (EFO)



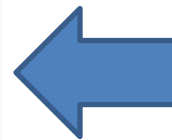
CA-NV River Forecast Center  
Ensemble Flow Forecast



Storage Forecast



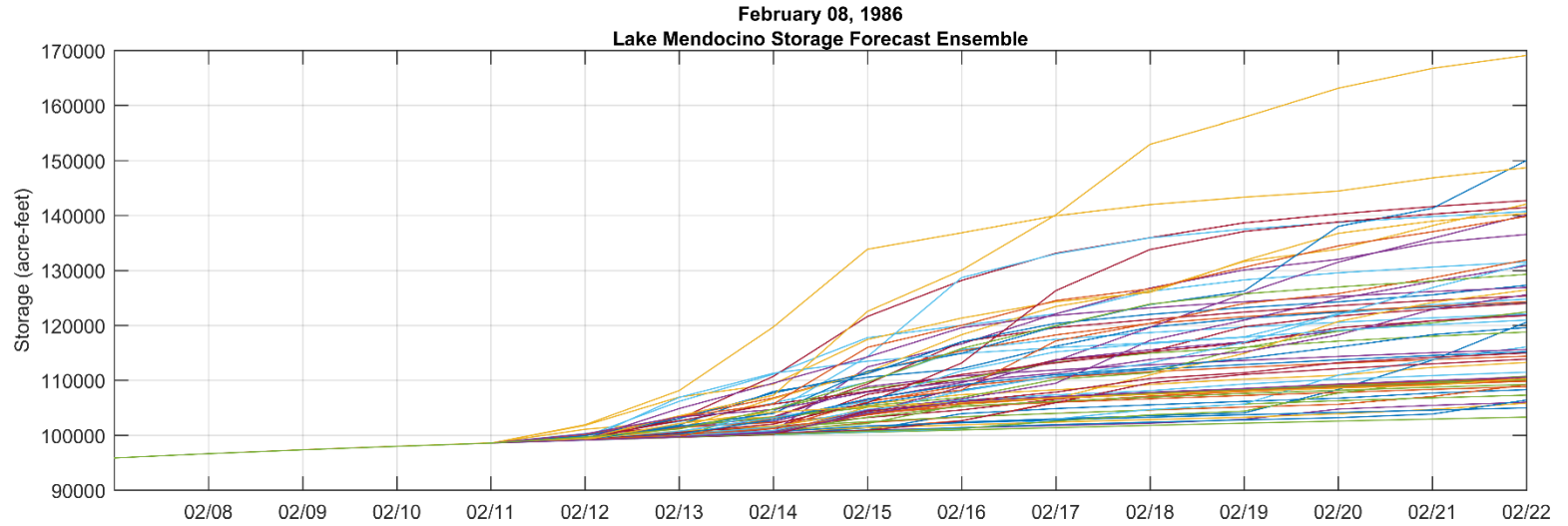
Flood Risk Analysis



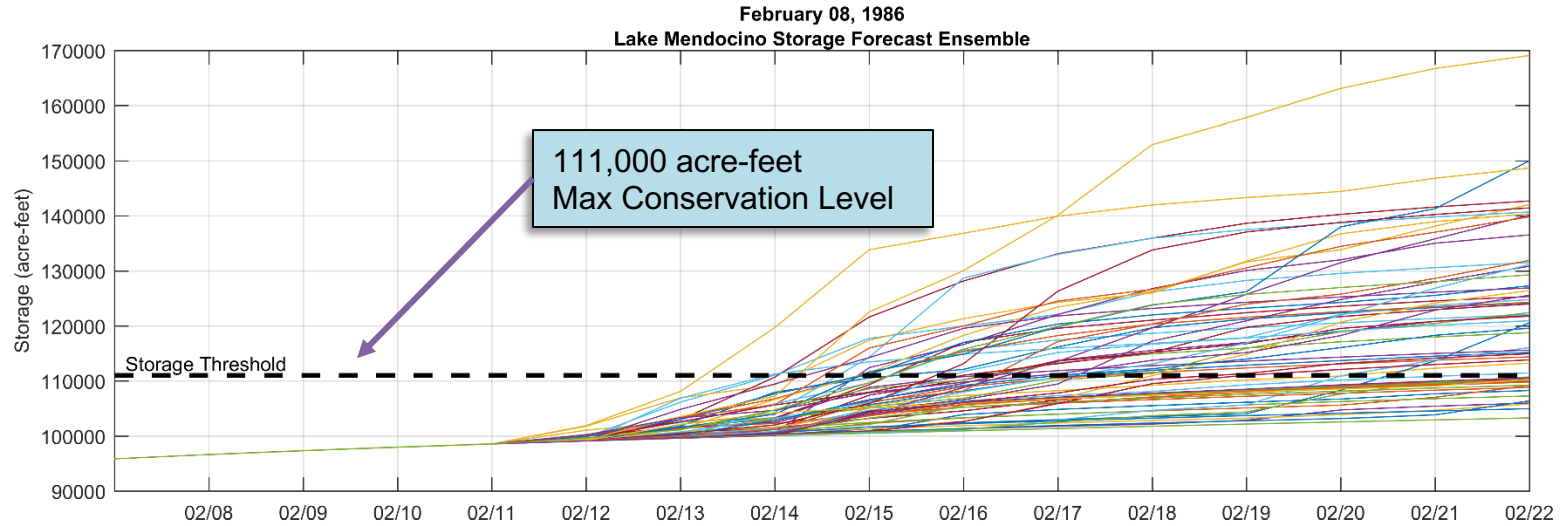
Flood Release

Process repeated each time step

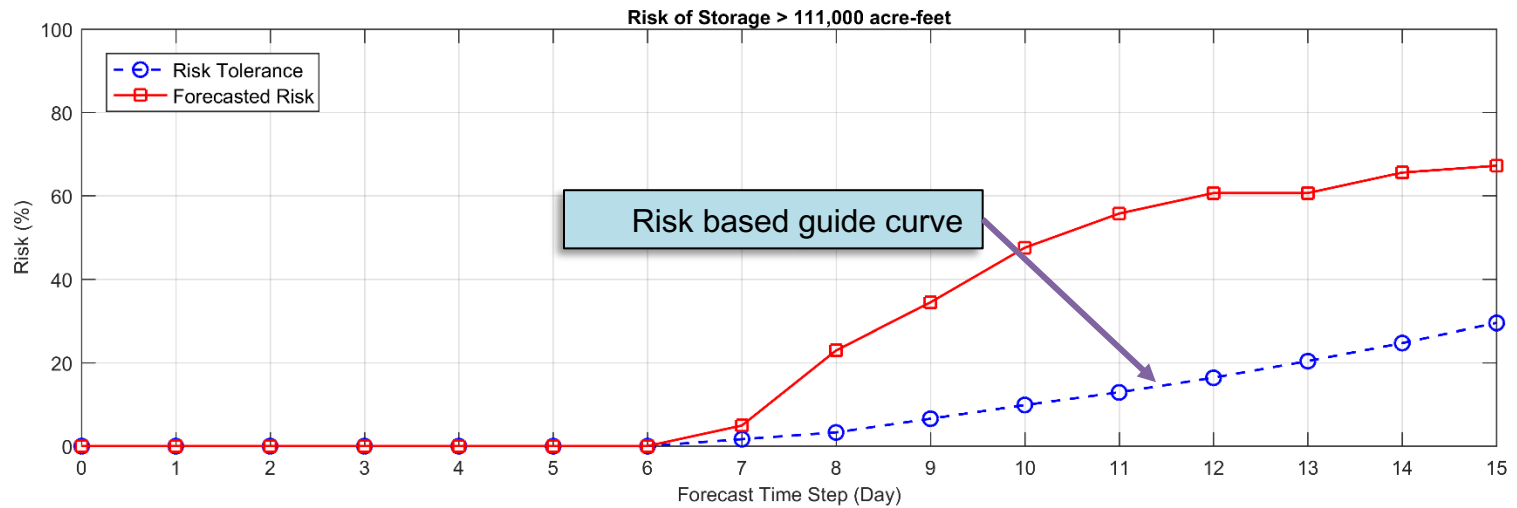
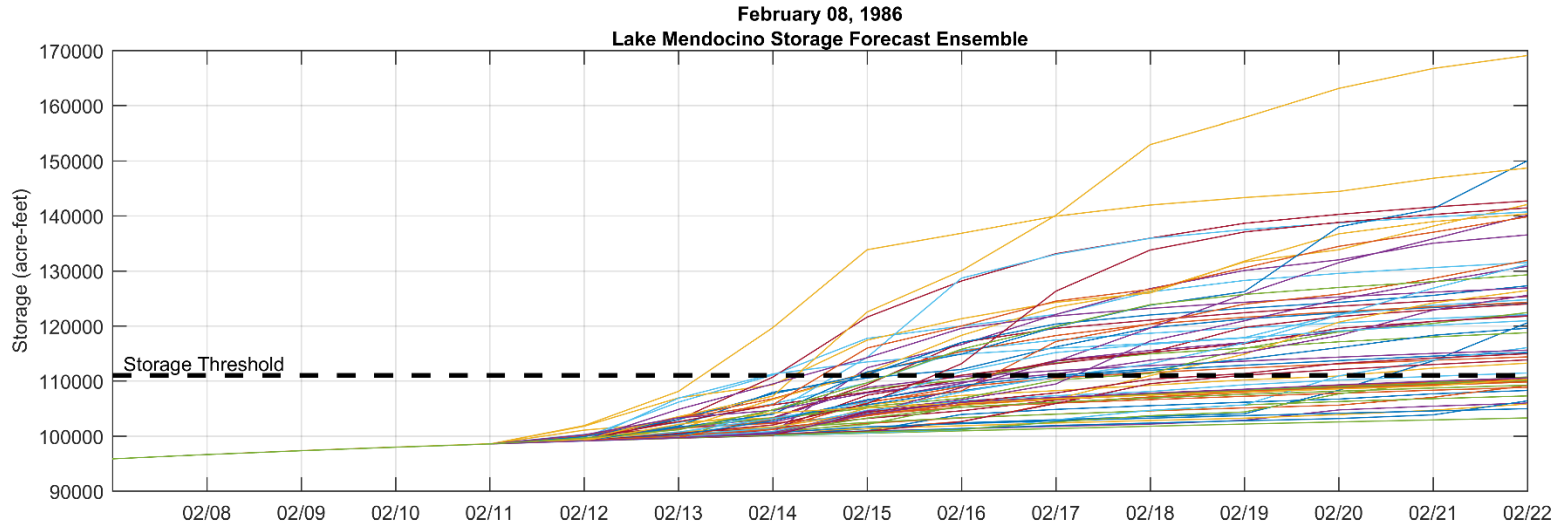
# February 8, 1986 Forecast



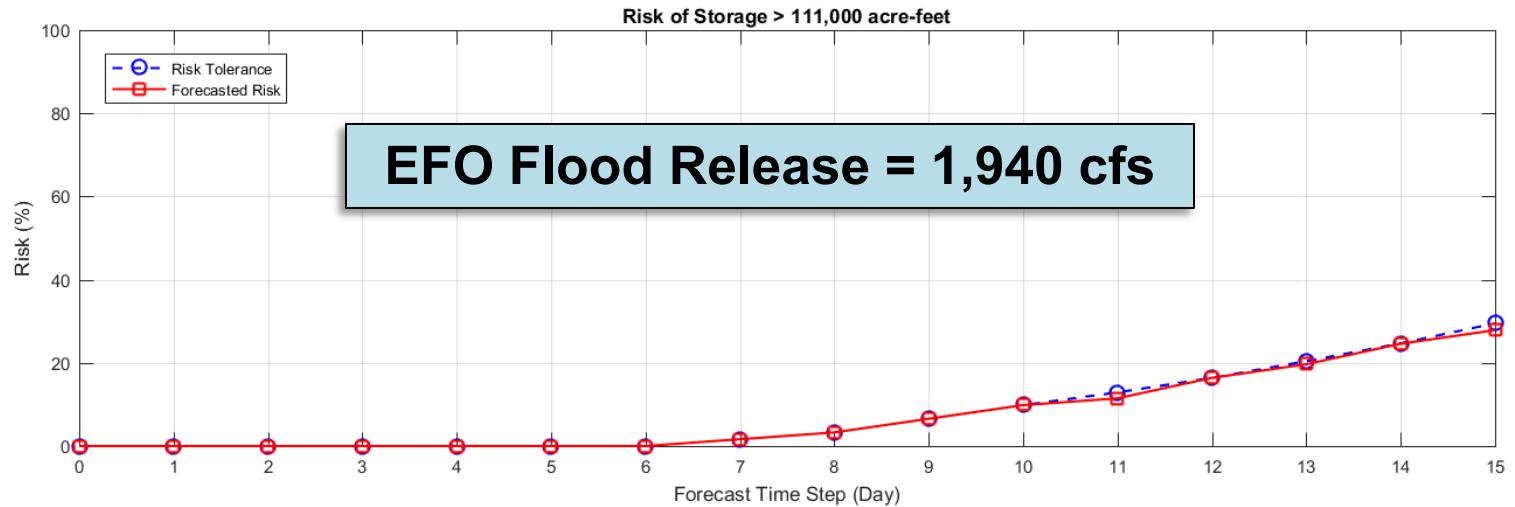
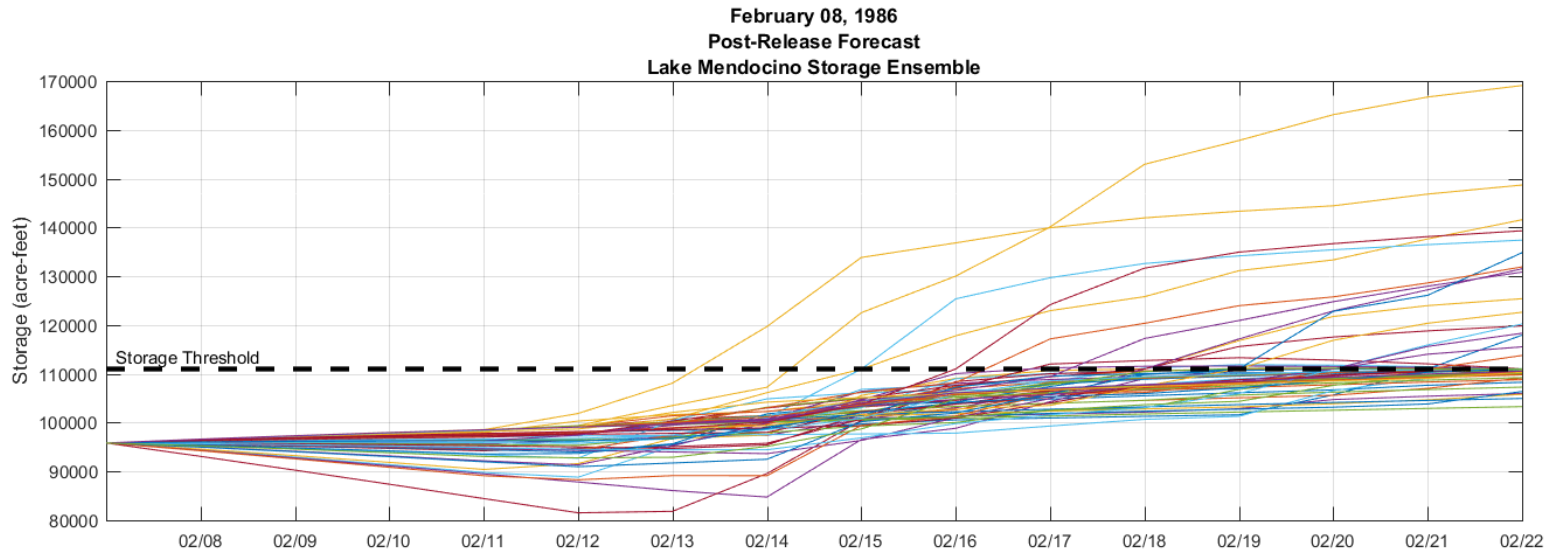
# February 8, 1986 Forecast



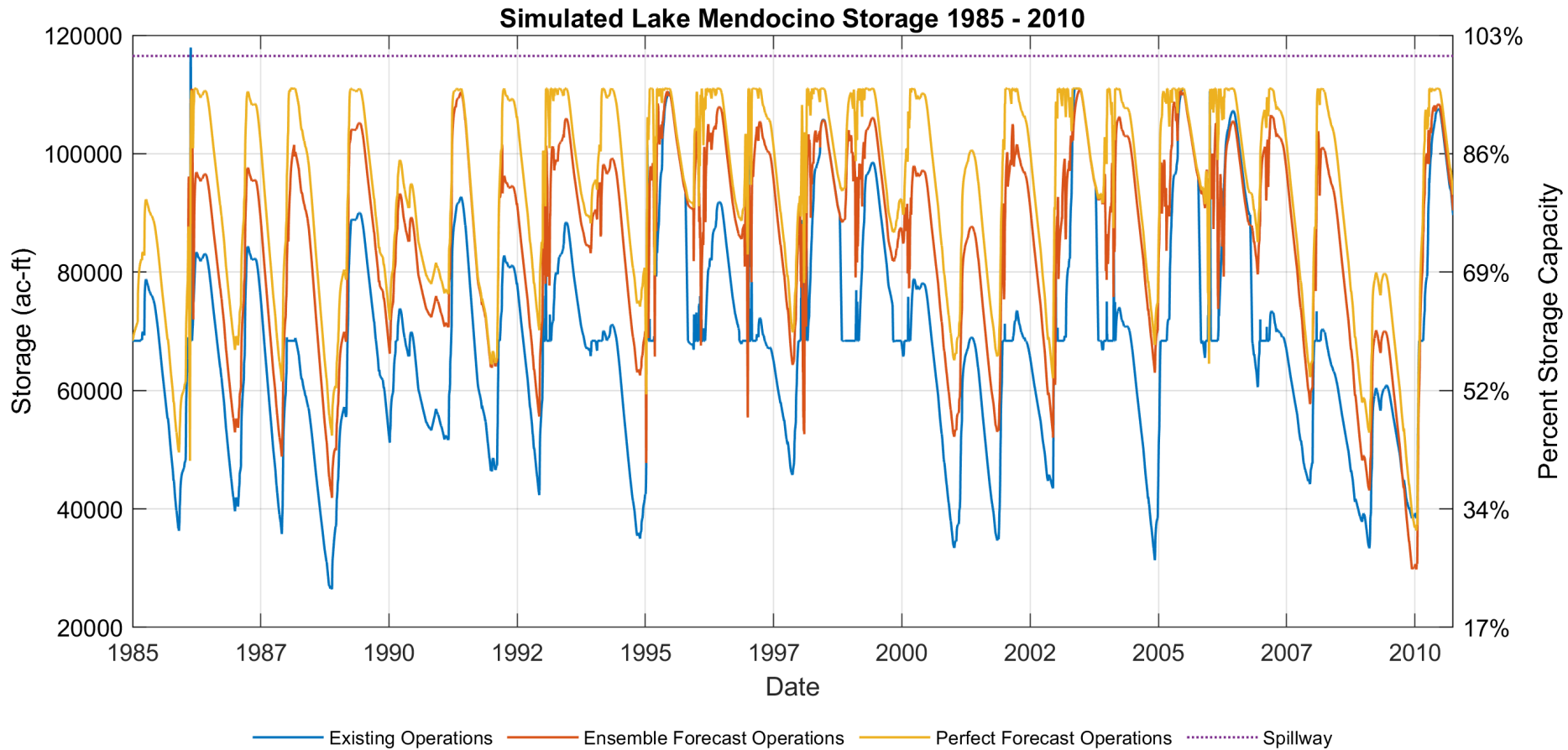
# February 8, 1986 Forecast



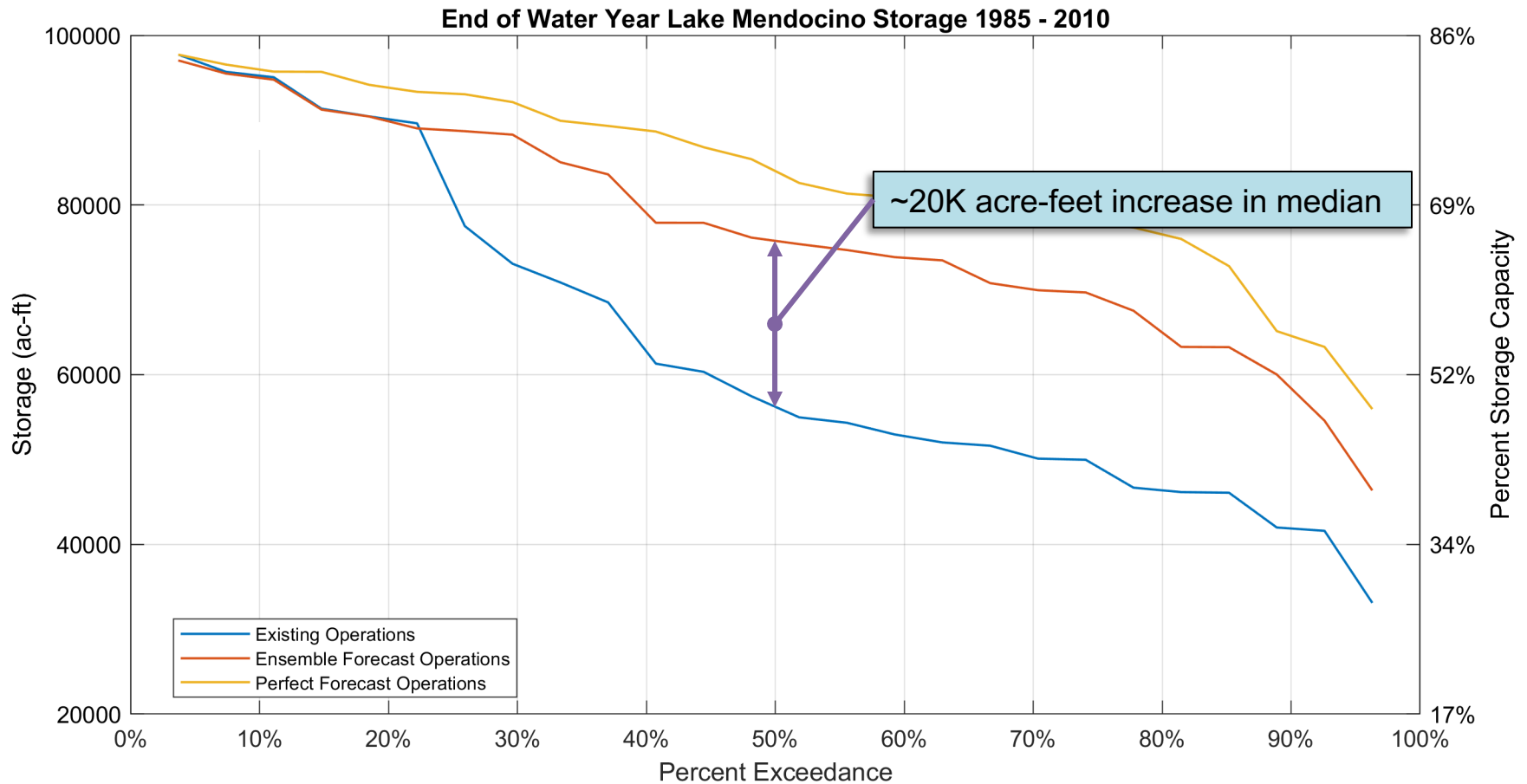
# February 8, 1986 Forecast



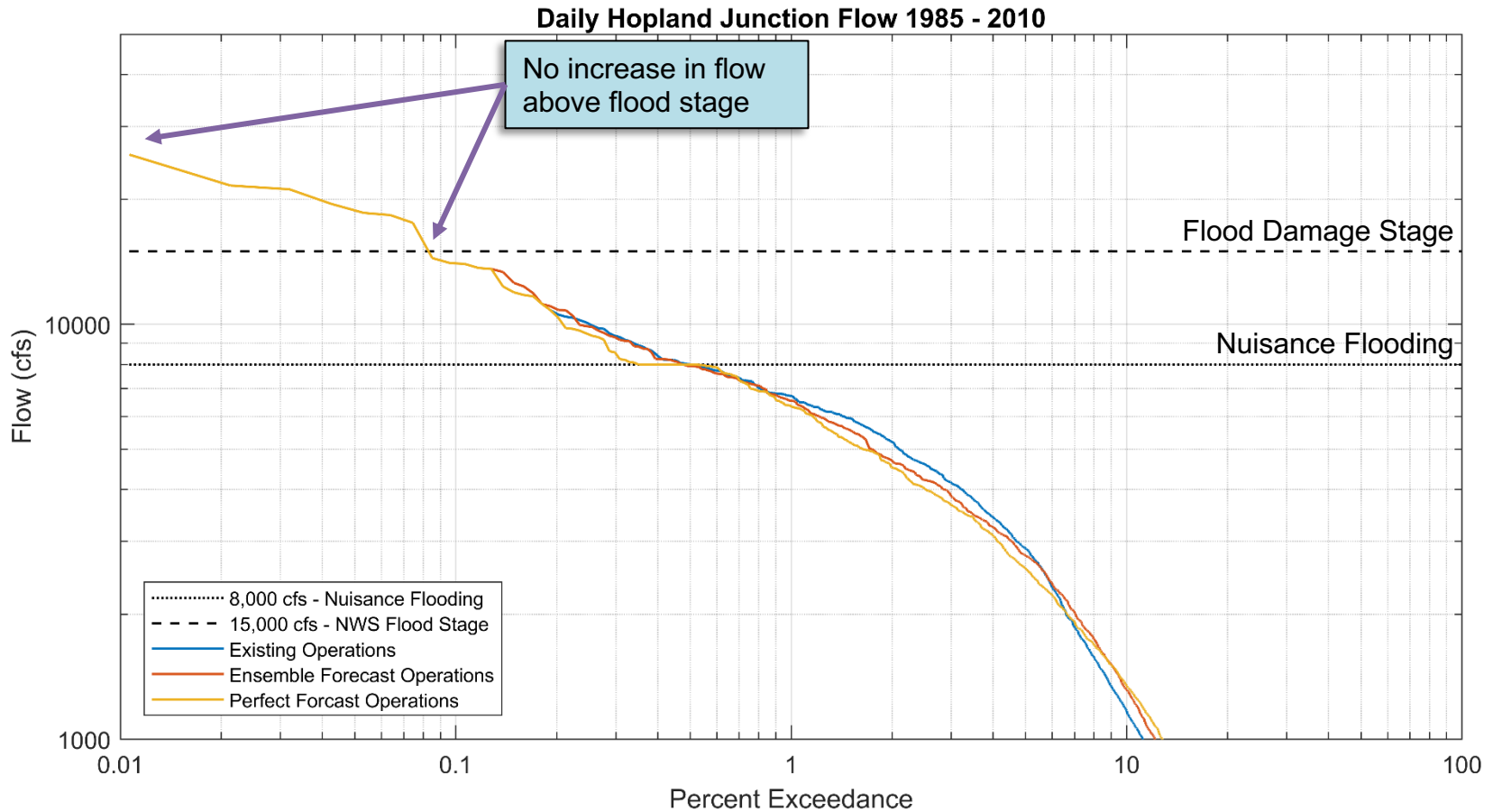
# 1985-2010 Historical Simulation Lake Mendocino Storage



# 1985-2010 Historical Simulation End of Water Year Storage



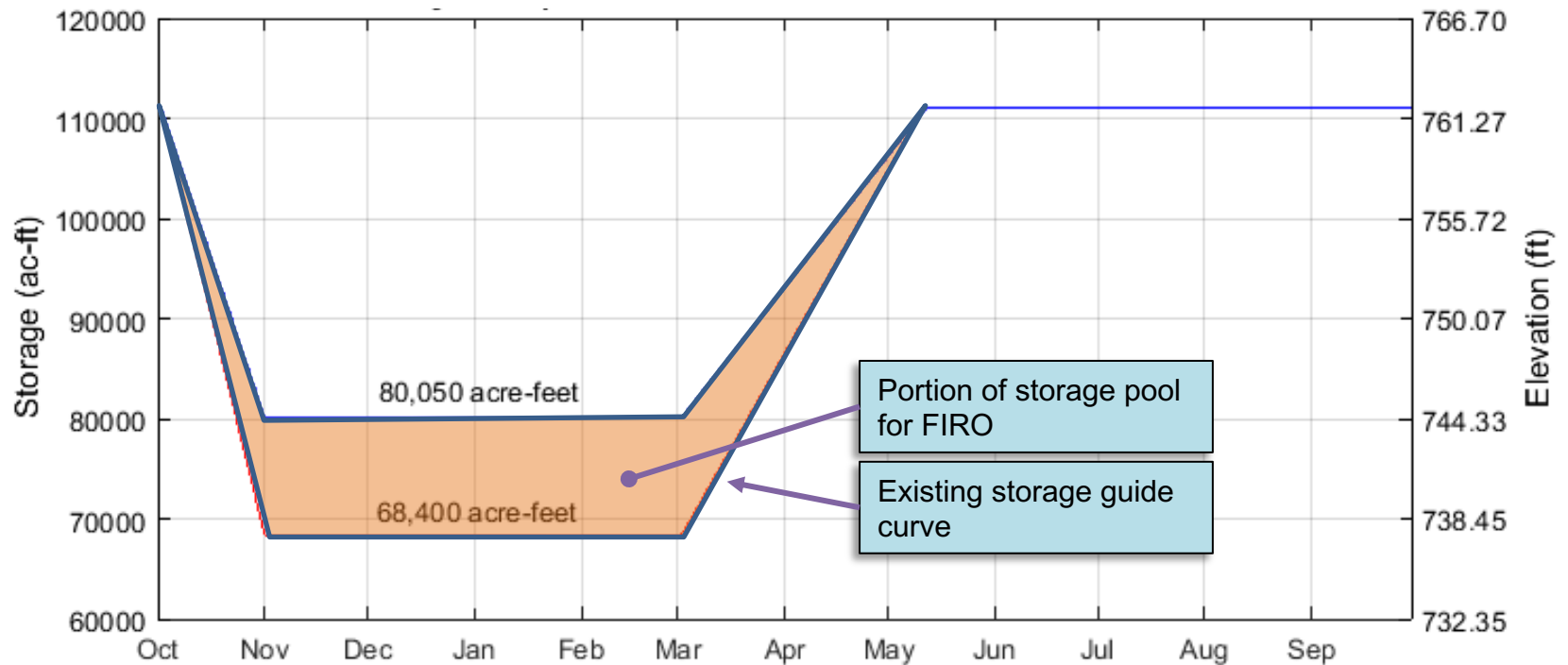
# 1985-2010 Historical Simulation Hopland Flows



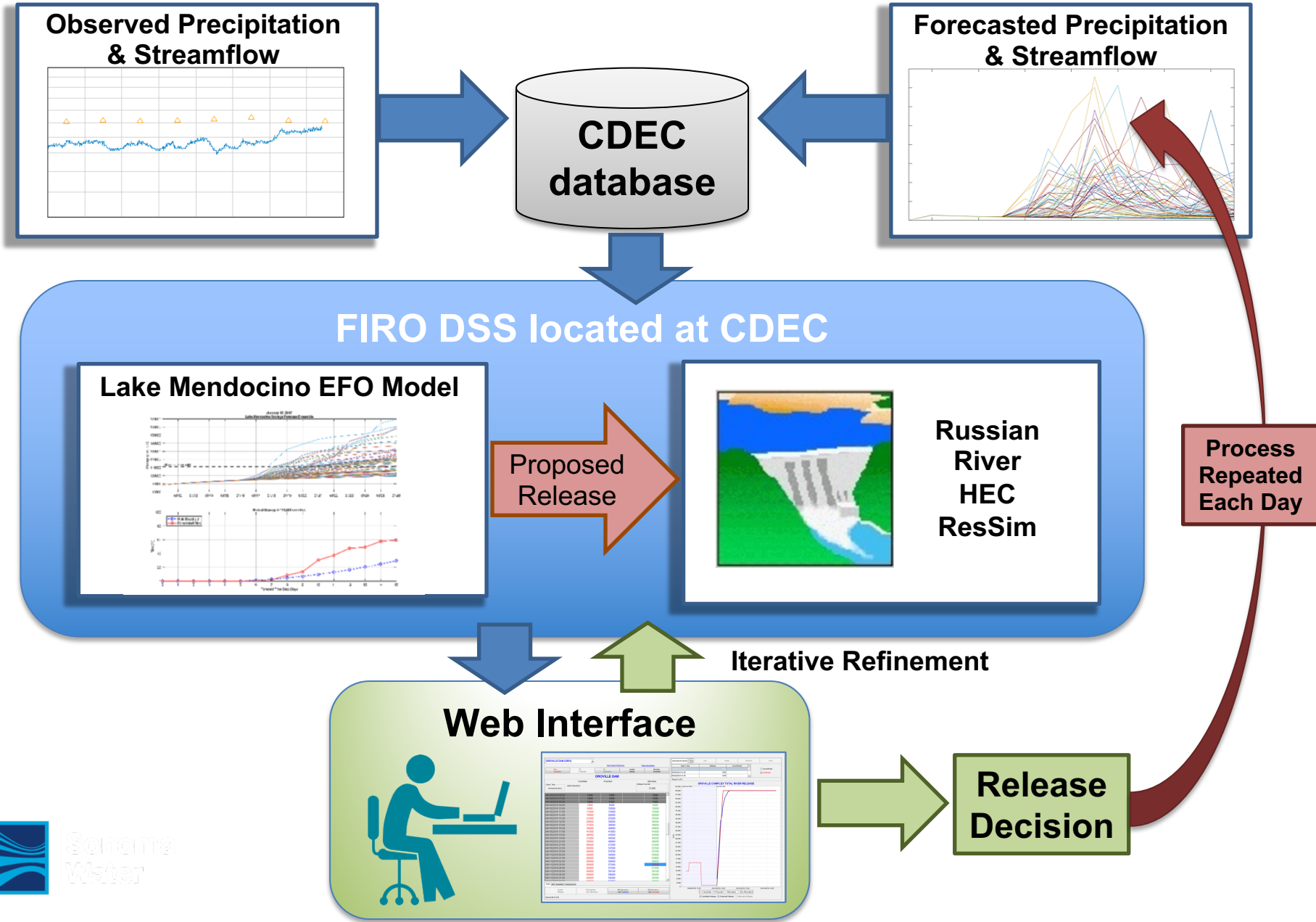


# 2019 & 2020 Major Deviations

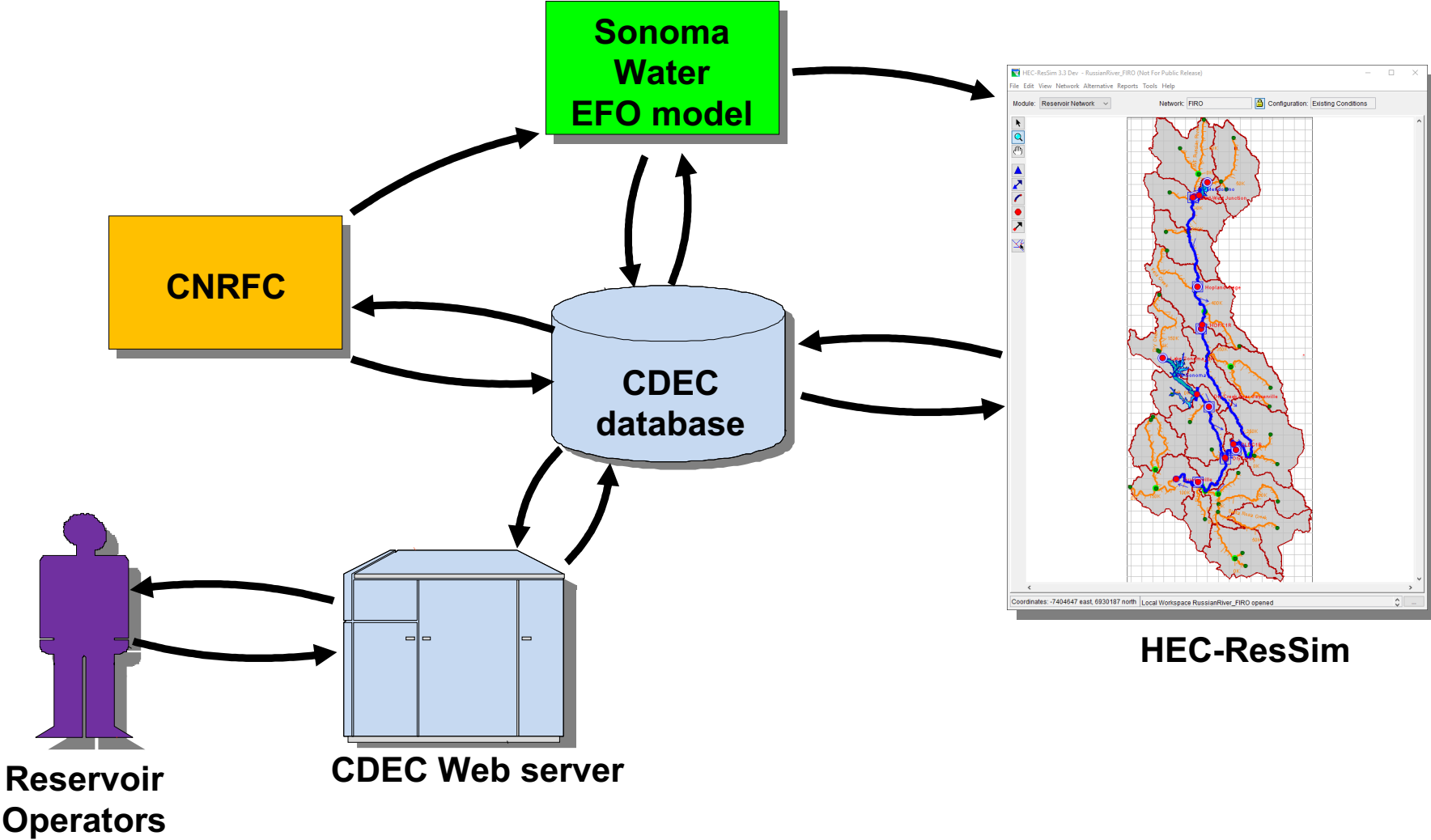
- Major Deviation to Water Control Manual
  - Approved by USACE



# FIRO Decision Support System (DSS)



# FIRO DSS Components

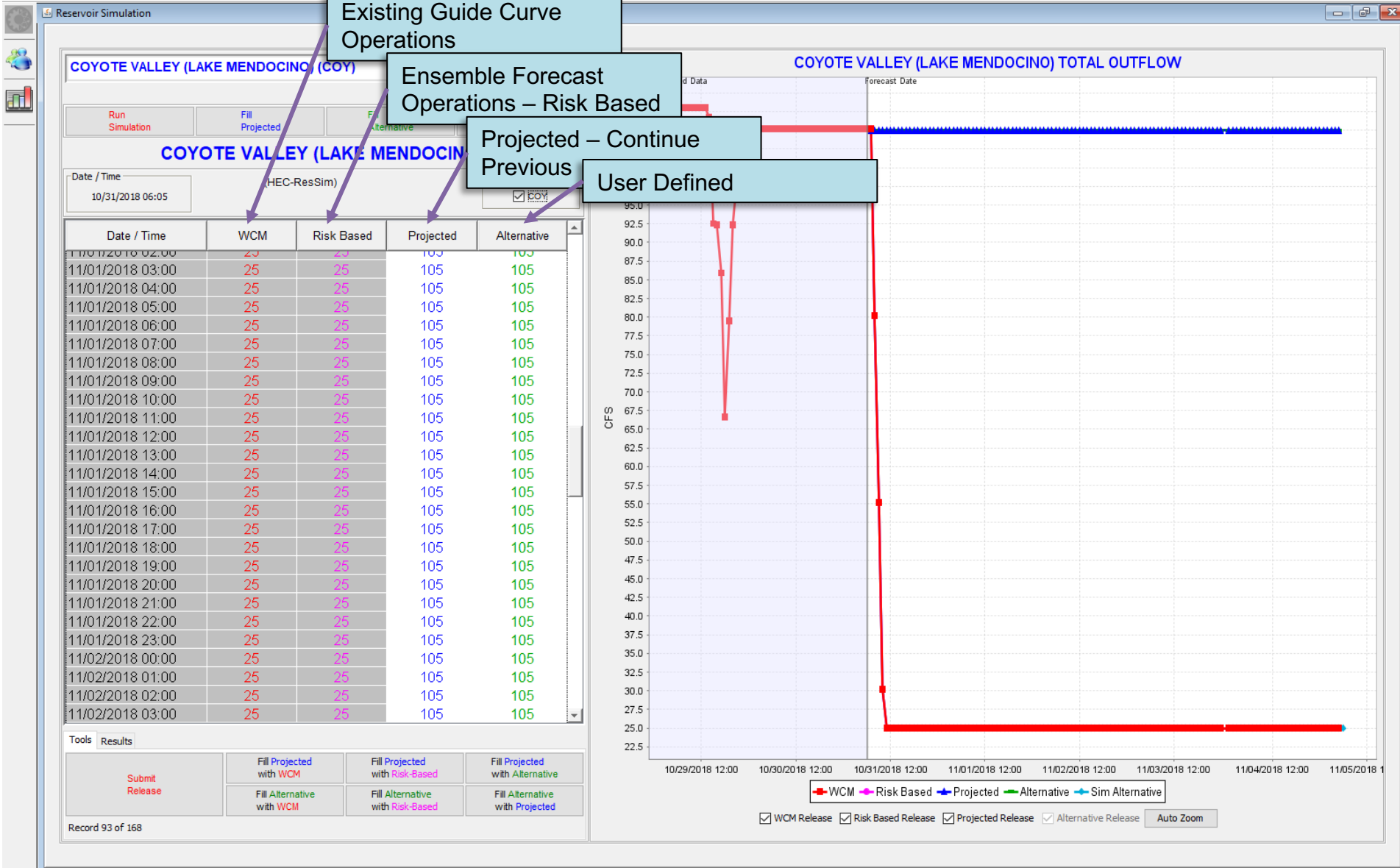


# DSS Web Interface



Forecast Coordinated Operations

File Edit View Tools Window Help



# Downstream Conditions



Downstream Target Flow

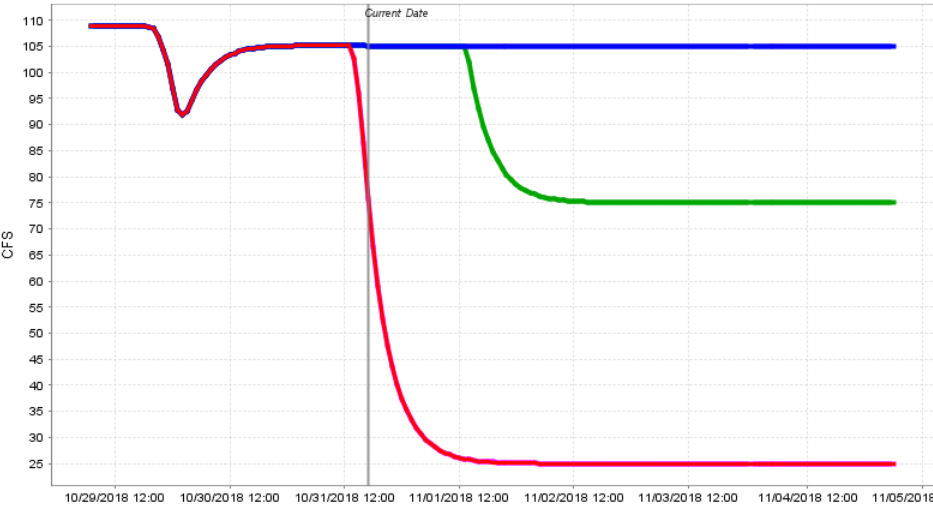


## Downstream Target Locations Results - Flow

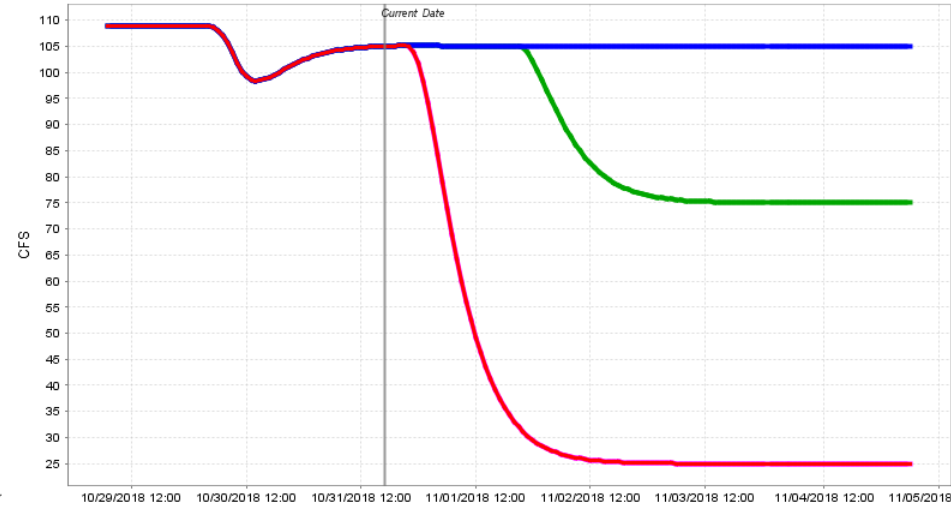
Simulation was executed on: 10/31/2018 16:48

Run Configuration: Release Override for COY

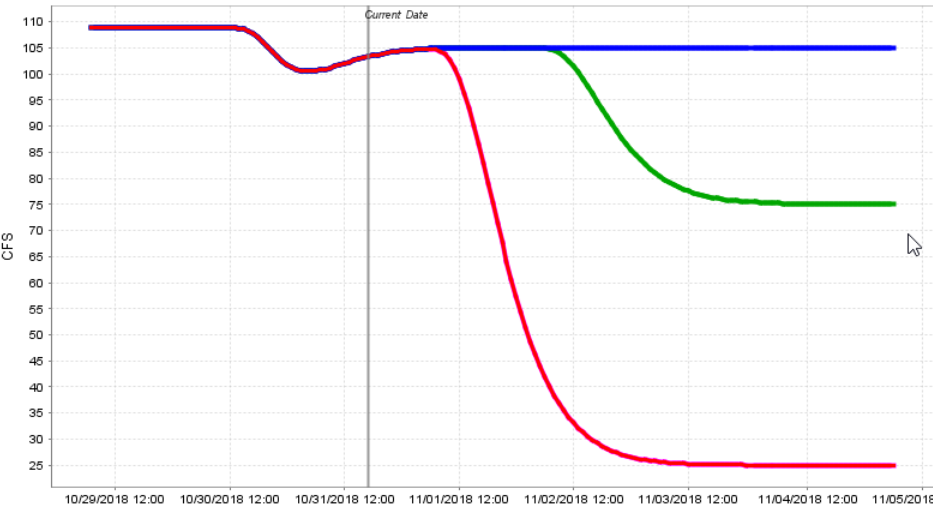
### RUSSIAN RIVER NEAR HOPLAND (HOP)



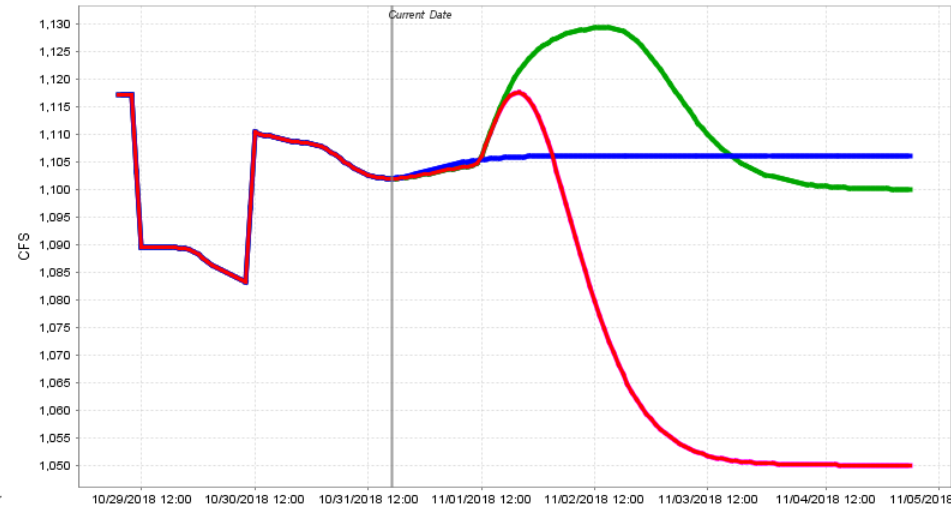
### RUSSIAN RIVER AT CLOVERDALE (CLV)



### RUSSIAN RIVER NEAR HEALDSBURG (HEA)



### RUSSIAN RIVER NEAR HACIENDA BRIDGE (HAC)



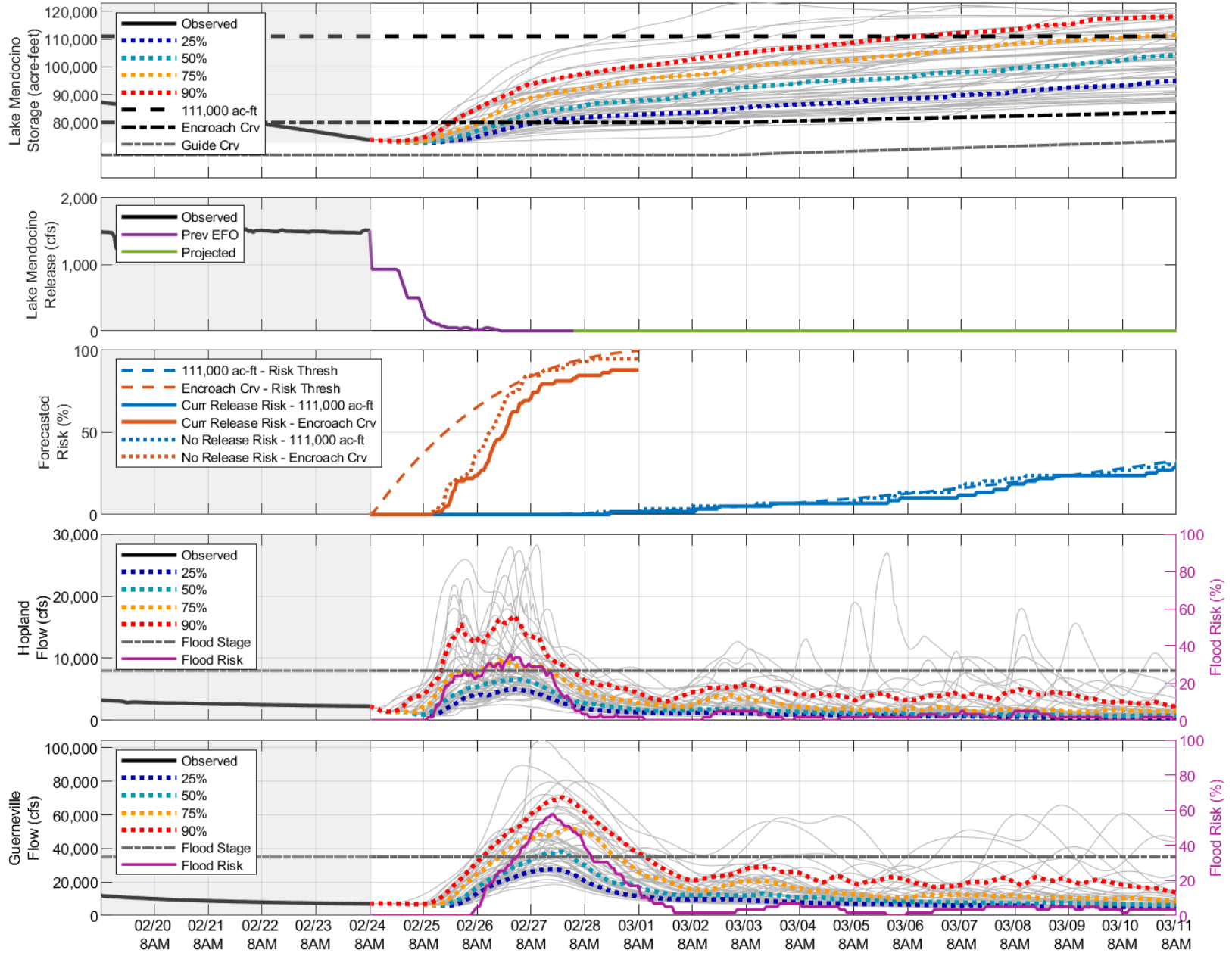
WCM

Risk Based

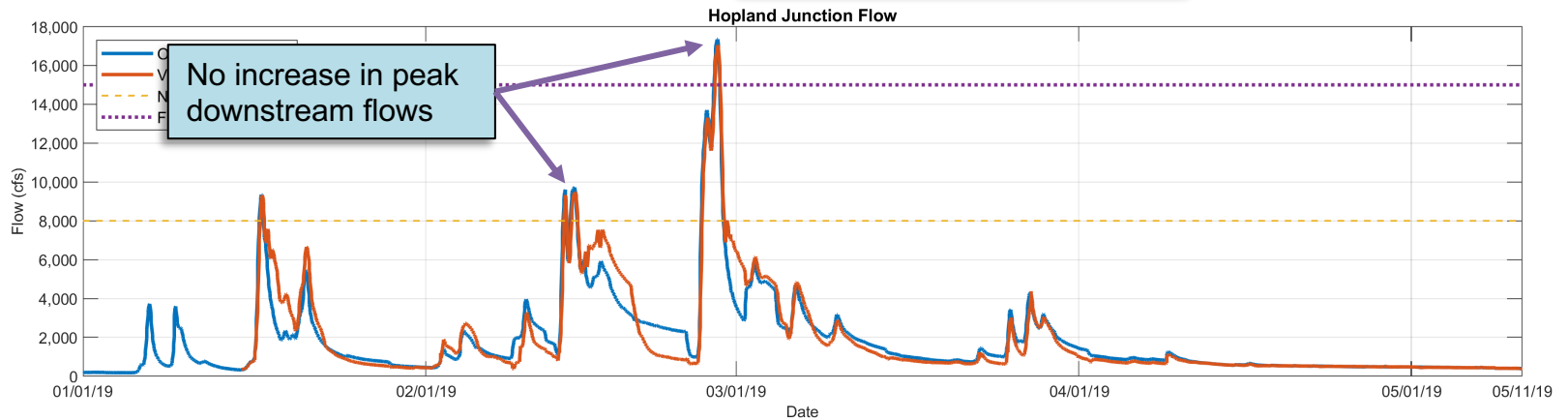
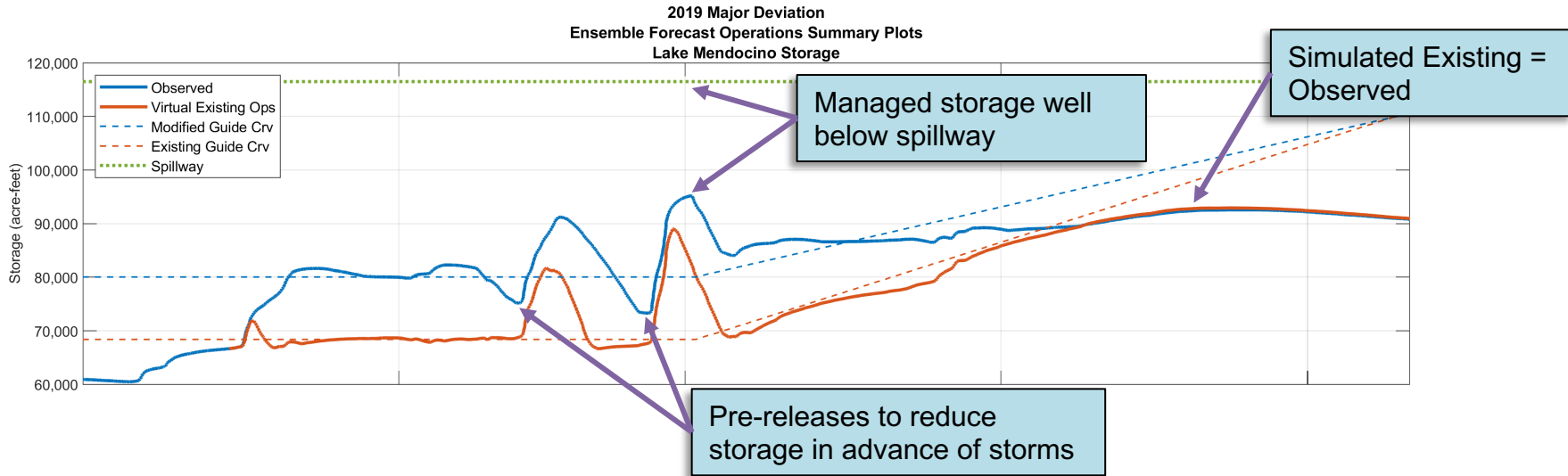
Projected

Alternative

9 AM February 24, 2019  
**Lake Mendocino Ensemble Forecast Operations - Multi-objective Hybrid**  
**Current Release Forecast**

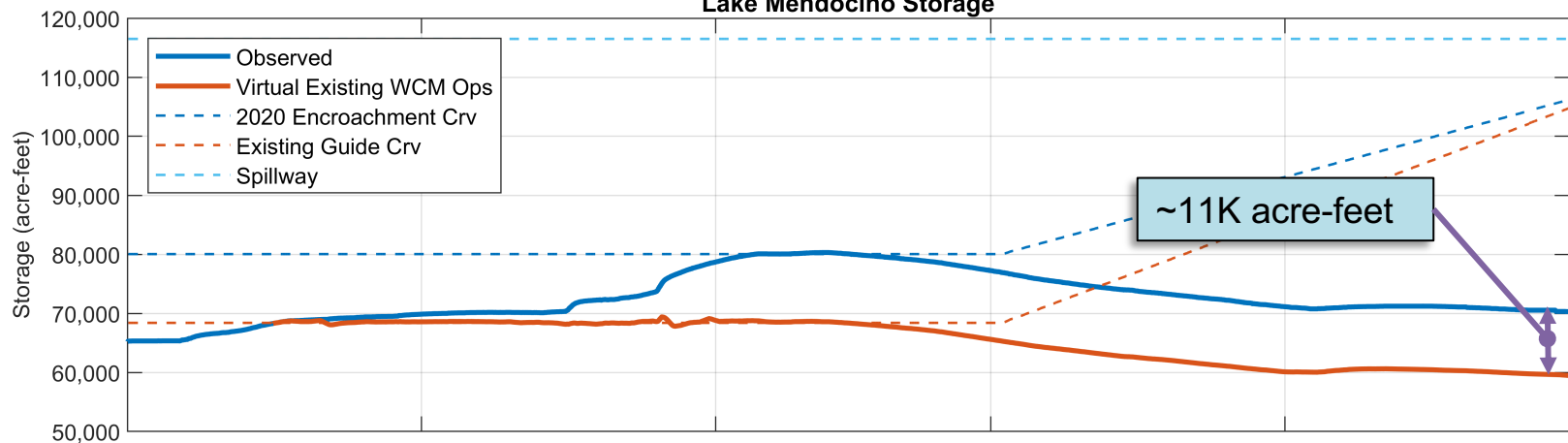


# 2019 Major Deviation

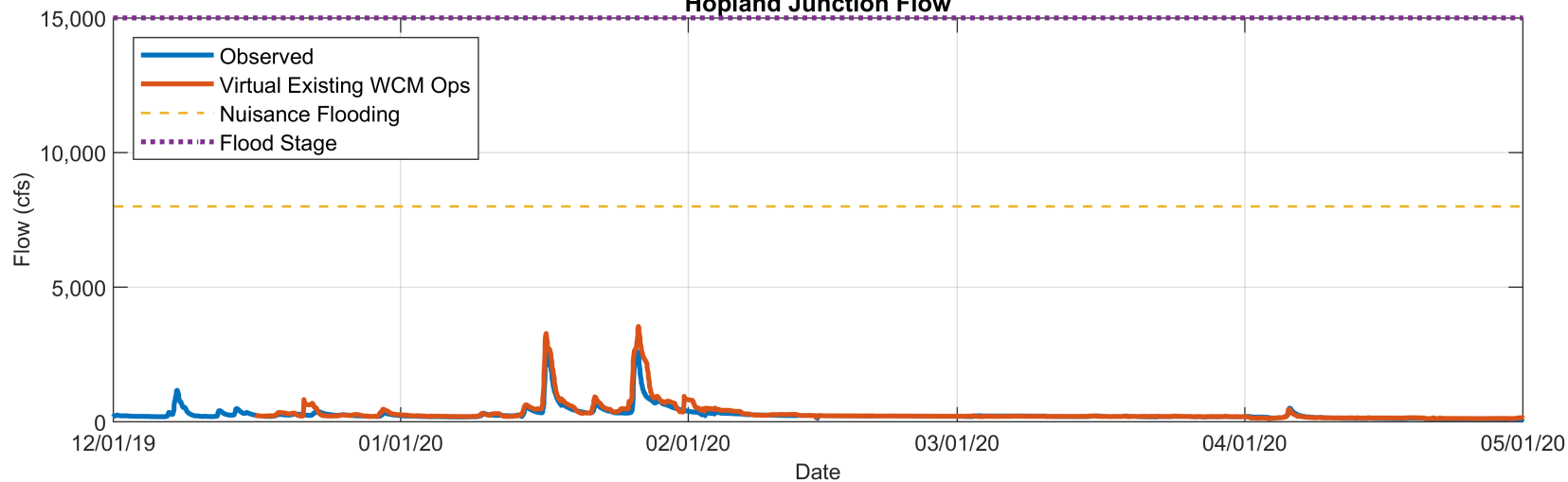


# 2020 Major Deviation

Water Year 2020 Major Deviation Summary Plots  
Lake Mendocino Storage



Hopland Junction Flow





# Next Steps

- **Final Viability Assessment**
- **2021 Major Deviation**
- **Water Control Manual Update**
- **Prado Reservoir**

# Thank You



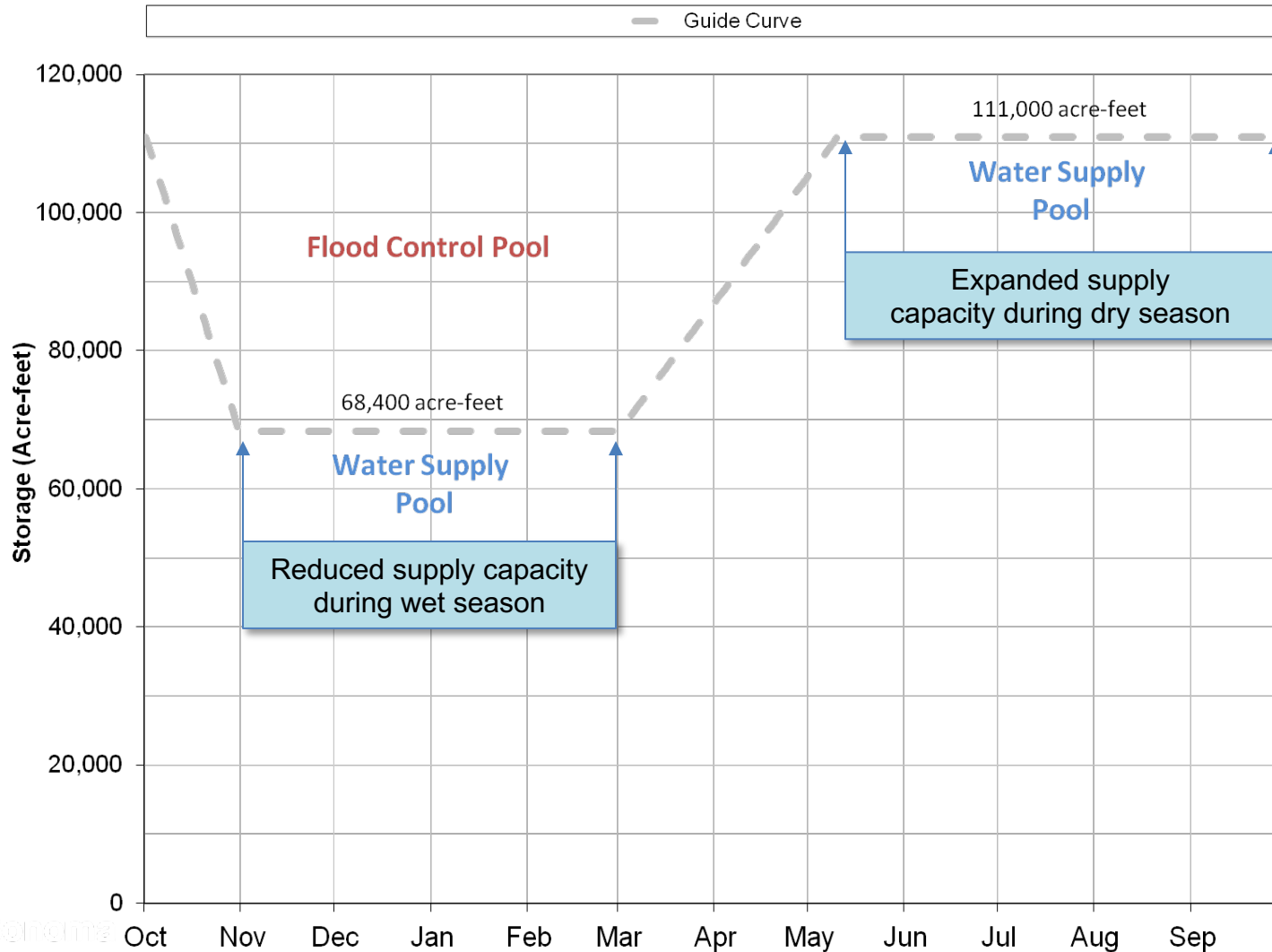
**Sonoma  
Water**

Chris Delaney  
Engineer  
[Chris.delaney@scwa.ca.gov](mailto:Chris.delaney@scwa.ca.gov)

    [sonomawater.ca.gov](http://sonomawater.ca.gov)

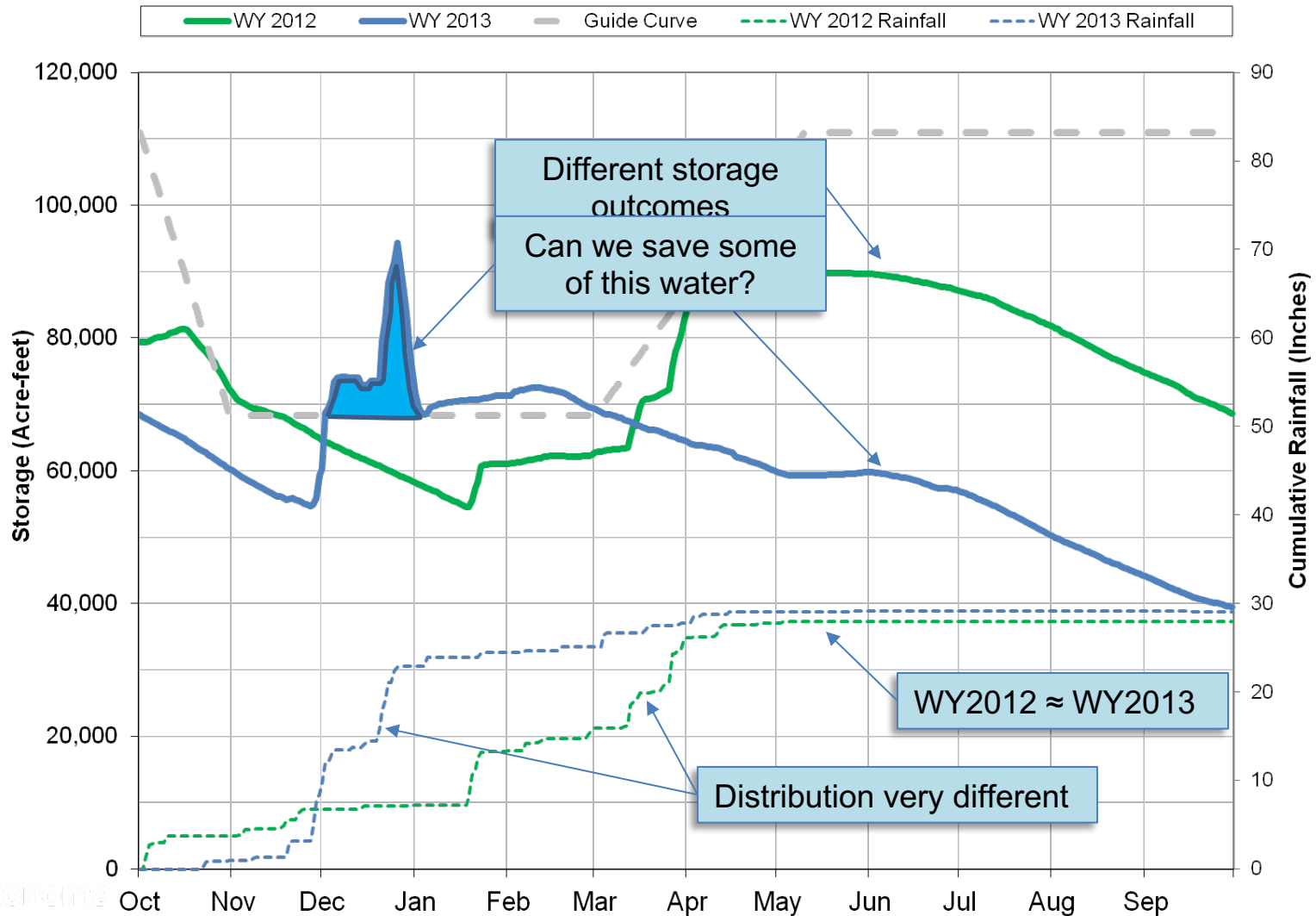
# Lake Mendocino Guide Curve

Lake Mendocino Storage Water Years 2012 & 2013



# Lake Mendocino Guide Curve

## Lake Mendocino Storage Water Years 2012 & 2013



# GSL-AQPI Slack Workspace Update

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**#general** > Question from Dave Turner (NOAA HRRR): “General Q for you out there: is there a nice reference (looking for only 1 or 2, ideally high-level) that discusses the importance of the atmospheric PBL evolution for hydrological modeling / applications?”

**#national\_water\_model** > New Channel for feedback and information based on the NWM

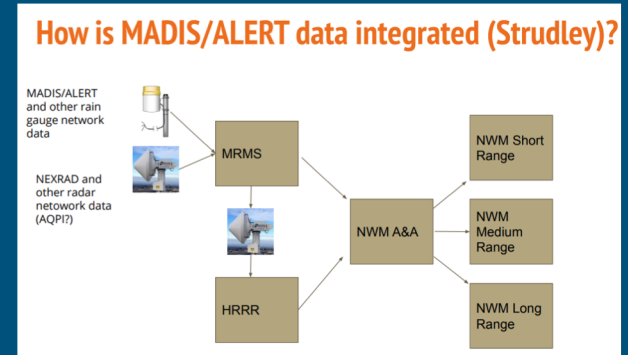
# NWM Dev - What can be done to improve the NWM as part of ongoing development?

## Organizational -

- **Give the NWM better precipitation inputs**
  - We are aiming to have the X-Bands incorporated into MRMS by Spring 2021!
  - Improving HRRR through radar inputs and other model advancements
  - Add gauges into MADIS (\*150 added recently!)
- **Add Water Management Information**
  - reservoir flow releases through CDEC and CNRFC (\*\*CNRFC participates AQPI Users Group)
- **Calibrate the NWM in more Bay Area watersheds**
- **Establish formal process with NOAA's Office of Water Prediction to "fix" the NWM**
  - Identify errors in gauge locations and stream reaches
  - Add additional gauges into the workflow

## User -

- Identify unregulated basins with 10+ yr gauge records
- Feedback on errors - gauge in wrong place, stream reaches not correct, simulated streamflow really bad



Being done as part of this grant

