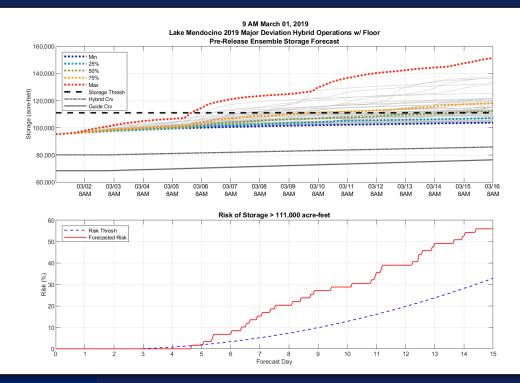


Forecast Informed Reservoir Operations 2019 Decision Support System

Chris Delaney Mike Konieczki Jay Jasperse Cary Talbot Marty Ralph Rob Hartman August 6, 2019



2019 Annual FIRO Workshop

Presentation Overview

Lake Mendocino Decision Support System

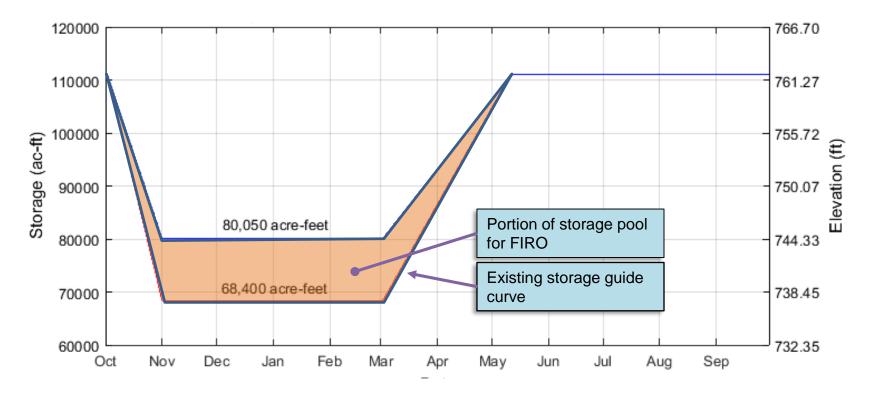
Ensemble Forecast Operations Model

2020 Next Steps

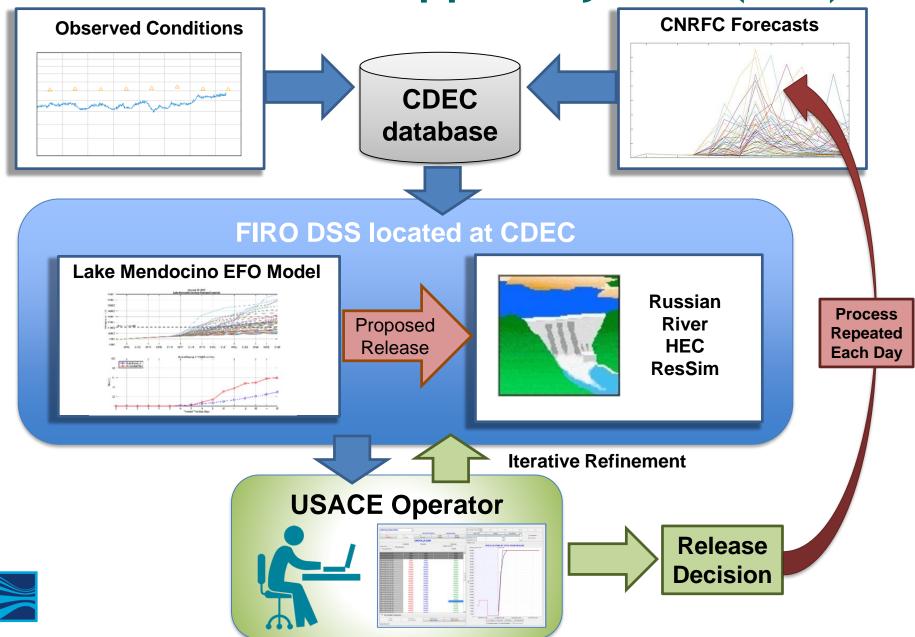


2019 Major Deviation

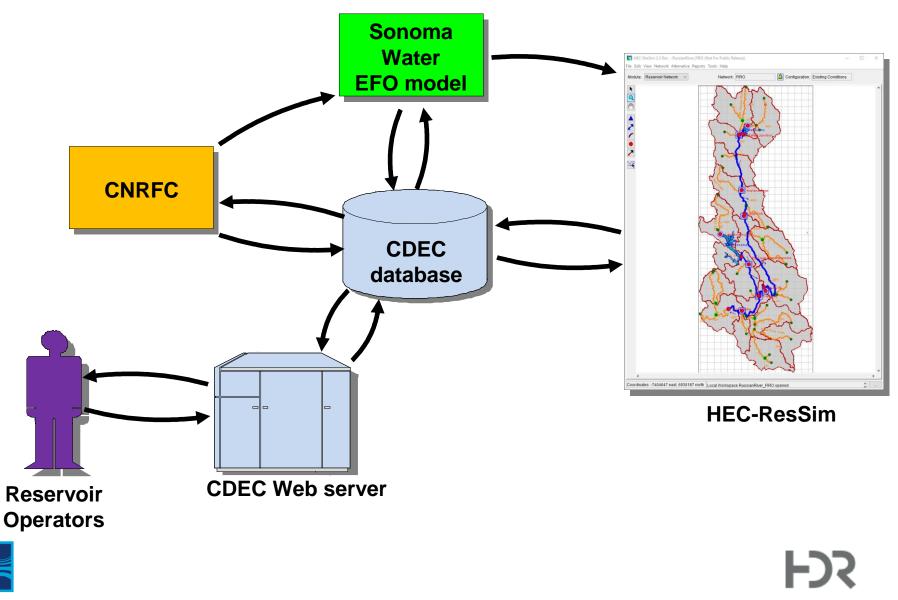
- Major Deviation to Water Control Manual
 - Approved by USACE in November 2018 for 2018/2019 winter and spring season



FIRO Decision Support System (DSS)



FIRO DSS Components

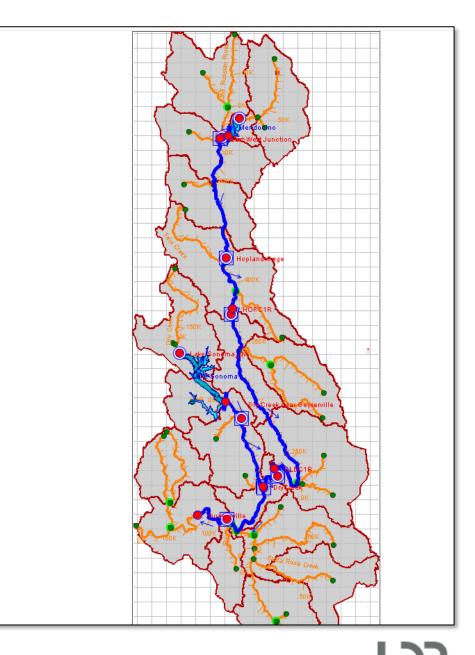


FIRO HEC-ResSim model

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- Based on PVA model developed by HEC
- 2 Reservoirs
 - Lake Mendocino
 - Lake Sonoma
- Variable Lag & K routing
- Releases from EFO model included as rule





DSS Web Interface



eservoir Simulation	ting Guide Curve												
COYOTE VALLEY (LAP			-	nble Foreca			СОУОТ			INO) TOTAL OL	JTFLOW		
J						d Data		Forecast Date					
Run	Fill	F	Opera	tions – Ris	k Base	ed 🗾	_						
Simulation	Projected	lite	mative	Projected	-Col	ntinue	_						
	ENDOCIN	Previous	<u> </u>										
Date / Time 10/31/2018 06:05	HEC-	ResSim)			Use	r Defined							
Date / Time	WCM	Risk Based	Projected	Alternative	92.9								
11/01/2010/02.00	20	23	105	105	87.5	;							
11/01/2018 03:00	25 25	25	105 105	105 105	85.0	· •							
11/01/2018 04:00 11/01/2018 05:00	25	25	105	105	82.5	5							
11/01/2018 06:00	25	25	105	105	80.0			•					
11/01/2018 07:00	25	25	105	105	77.5								
11/01/2018 08:00	25	25	105	105	75.0								
11/01/2018 09:00	25	25	105	105	72.								
11/01/2018 10:00	25	25	105	105	70.0								
11/01/2018 11:00	25	25	105	105	0 67.5								
11/01/2018 12:00	25	25	105	105	00.								
11/01/2018 13:00	25	25	105	105	62.9								
11/01/2018 14:00	25	25	105	105	57.5								
11/01/2018 15:00	25	25	105	105	55.0								
11/01/2018 16:00	25	25	105	105	52.5			I					
11/01/2018 17:00	25	25	105	105	52.								
11/01/2018 18:00	25	25	105	105	47.5								
11/01/2018 19:00	25	25	105	105	45.0								
11/01/2018 20:00	25	25	105	105	42.5								
11/01/2018 21:00	25 25	25	105	105	40.0								
11/01/2018 22:00	25 25	20	105	105	37.5								
11/01/2018 23:00 11/02/2018 00:00	25 25	25	105 105	105 105	35.0								
11/02/2018 00:00	20 25	20	105	105	32.5								
11/02/2018 01:00	25	25	105	105	30.0								
11/02/2018 03:00	25	25	105	105 -	27.5	5							
Tools Results	20	20	100	100 [*	25.0								
Submit	Fill Projected Fill P with WCM with		Projected Fill Projected Risk-Based with Alternative		22.	10/29/2018 12:00	10/30/2018 12:00	10/31/2018 12:00	11/01/2018 12:00	11/02/2018 12:00	11/03/2018 12:00	11/04/2018 12:00	11/05
Release	Fill Alternative Fill		Alternative h Risk-Based	Fill Alternative with Projected			- W	WCM 🔶 Risk Based 📥 Projected 🛥 Alternative 🔶 Sim Alternative			ernative		

User Name: MAXB Operator: FORD

Online

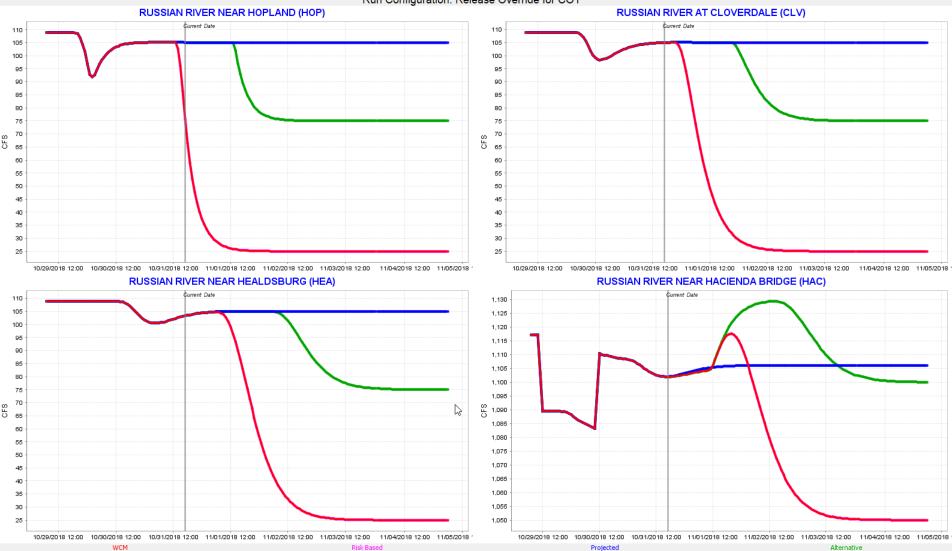
Forecast Coordinated Operations

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



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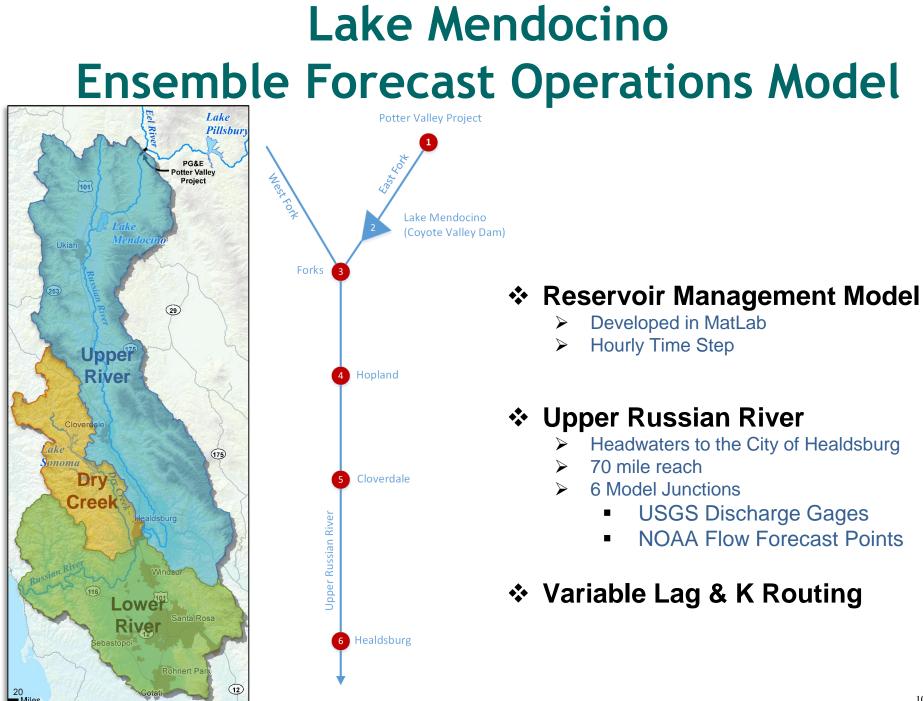
Presentation Overview

Lake Mendocino Decision Support System

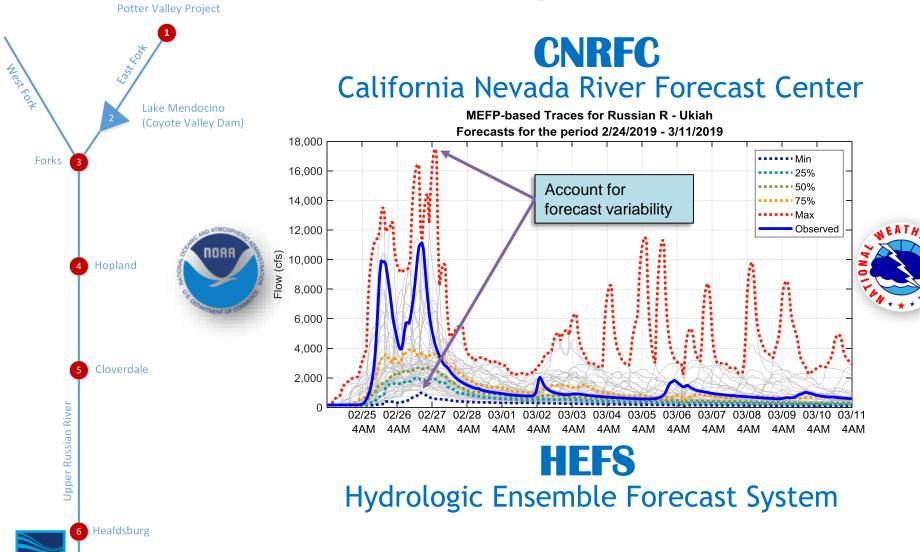
Ensemble Forecast Operations Model

2020 Next Steps

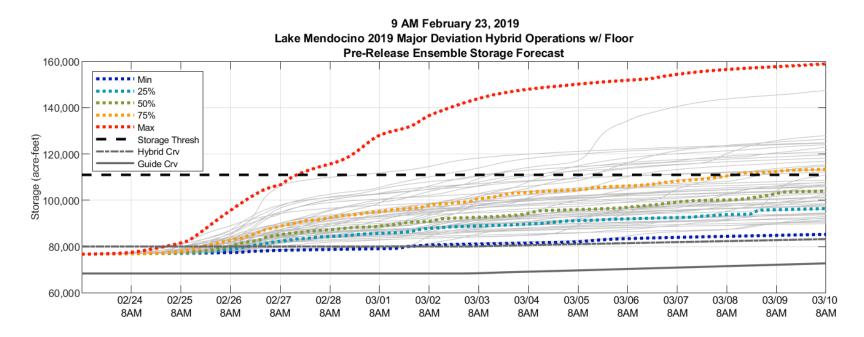




Lake Mendocino Ensemble Forecast Operations Model

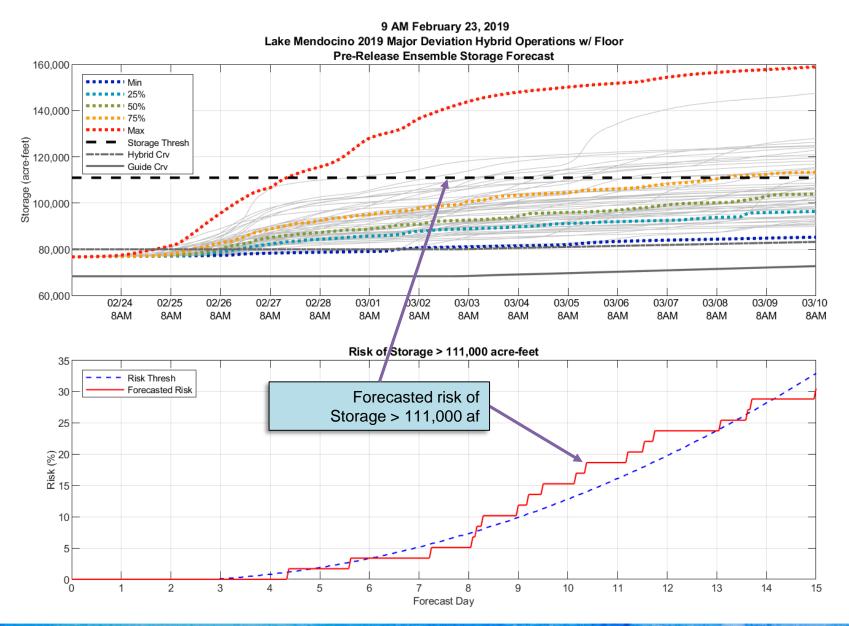


February 23 EFO Forecast

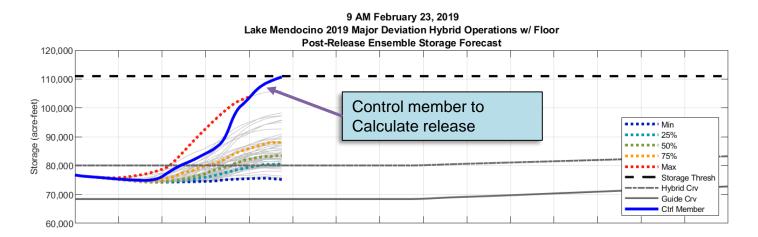




February 23 EFO Forecast

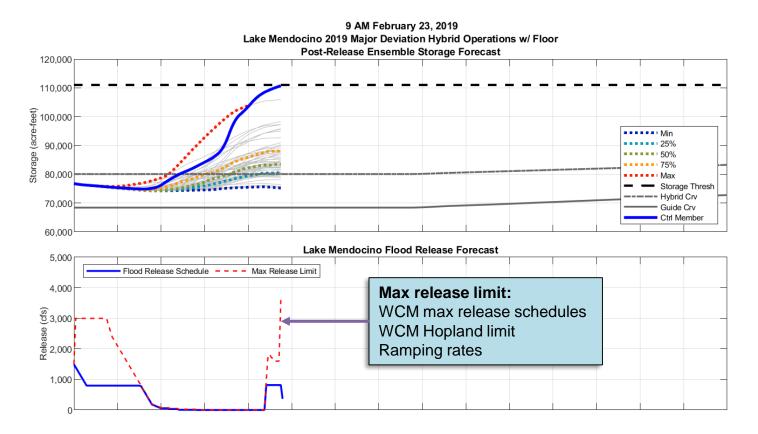


February 23 Release Forecast



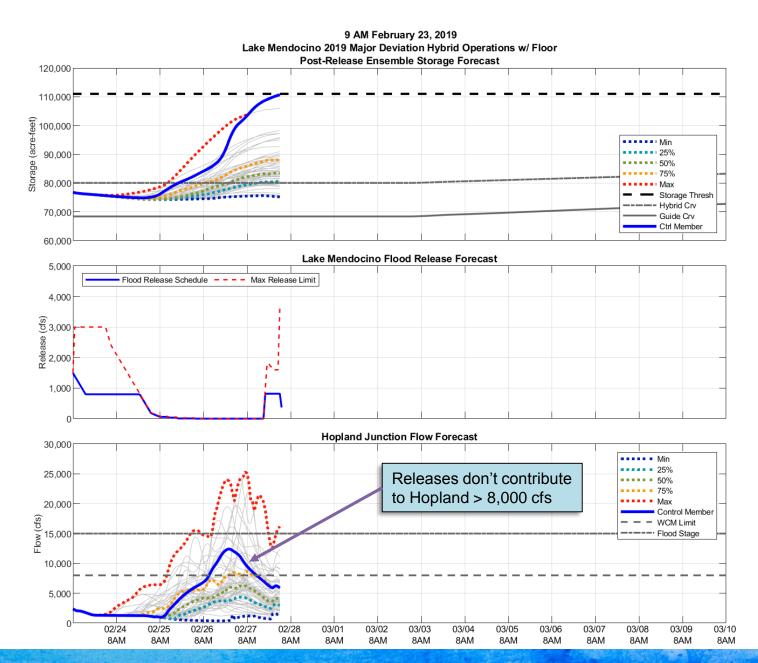


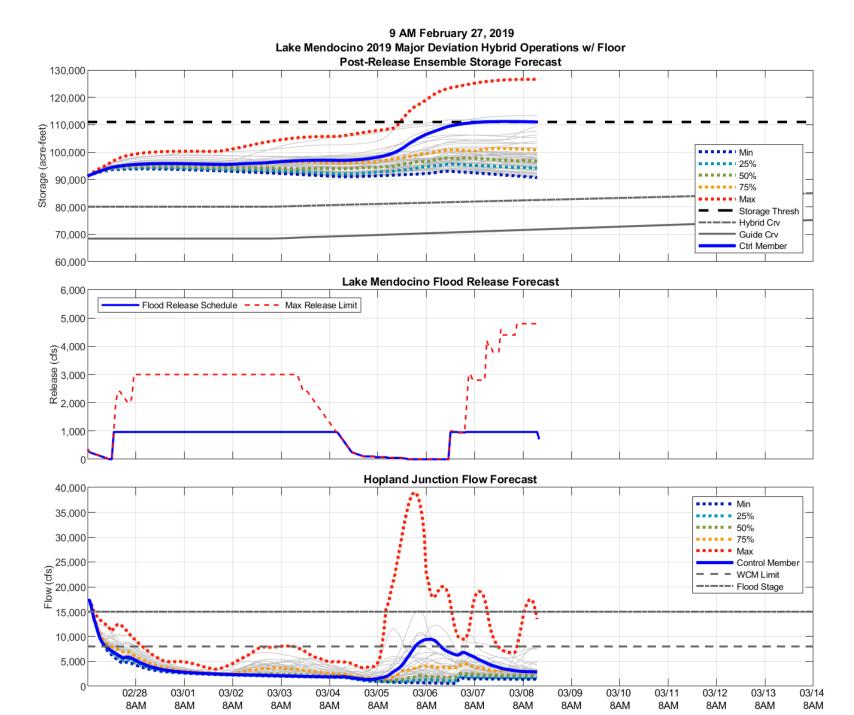
February 23 Release Forecast





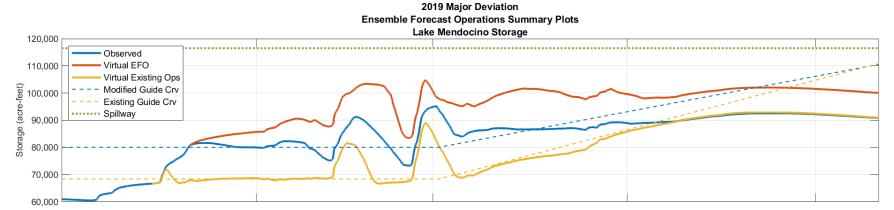
February 23 Release Forecast













Lake Mendocino Storage 120.000 Observed Virtual EFO 110,000 Virtual Existing Ops Storage (acre-feet) Modified Guide Crv 100,000 Existing Guide Crv Spillway 90,000 80,000 70,000 60,000 Lake Mendocino Inflow and Release 6,000 Observed Release 5,000 Virtual EFO Release Virtual Existing Ops Release (c) 3,000 8elease 2,000 Observed Inflow 24hr Ave. 1,000 0

2019 Major Deviation **Ensemble Forecast Operations Summary Plots**



Lake Mendocino Storage 120.000 Observed Virtual EFO 110,000 Virtual Existing Ops Storage (acre-feet) Modified Guide Crv 100,000 Existing Guide Crv --- Spillway 90,000 80,000 70,000 60,000 Lake Mendocino Inflow and Release 6,000 Observed Release 5,000 Virtual EFO Release Virtual Existing Ops Release (c) 3,000 2,000 Observed Inflow 24hr Ave. 1,000 0 Hopland Junction Flow Observed 15,000 Virtual EFO Virtual Existing Ops Nuisance Flooding 000,01 (cfs) Flow (cfs) ····· Flood Stage 5,000 01/01/19 02/01/19 03/01/19 04/01/19 05/01/19 05/11/19 Date

2019 Major Deviation **Ensemble Forecast Operations Summary Plots**

Presentation Overview

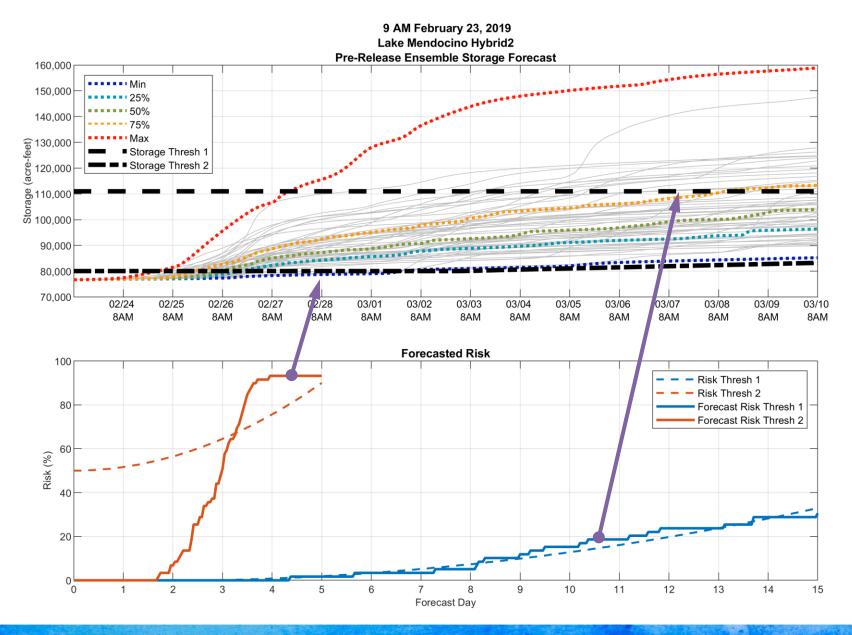
Lake Mendocino Decision Support System

Ensemble Forecast Operations Model

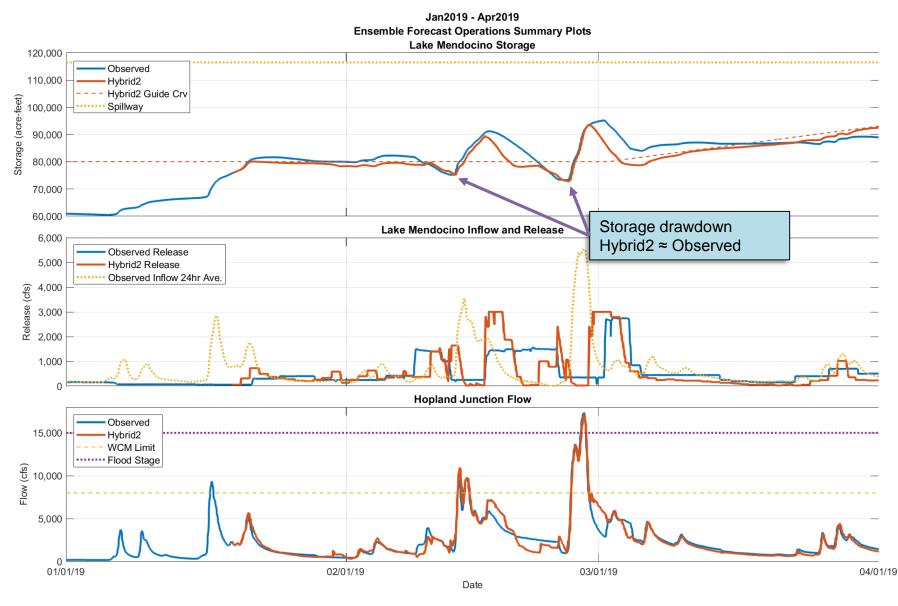
2020 Next Steps



2020 Major Deviation Hybrid



2020 Major Deviation Hybrid



2020 DSS Improvements

- Russian River HEC-ResSim Model
 - Refine flow routing
- EFO Model
 - Hybrid 2 multiple storage thresholds
 - Extend model to Lower Russian River
 - Add rule for managing to Guerneville flows
- Web Interface
 - Incorporate EFO figures in the web interface
 - Links to other forecast products:
 - CNRFC
 - CW3E

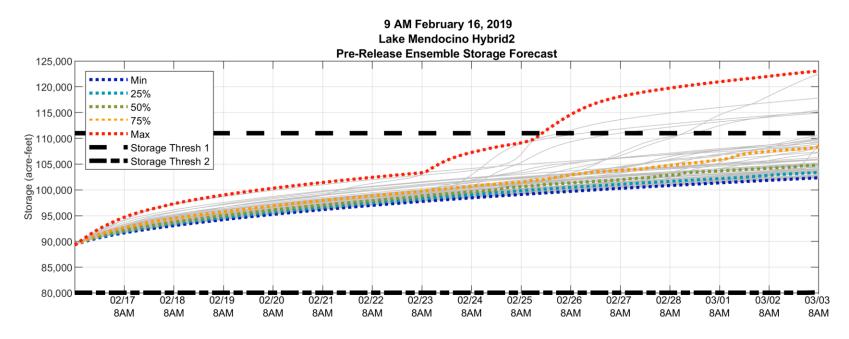
Thank You



Chris Delaney Engineer Chris.delaney@scwa.ca.gov

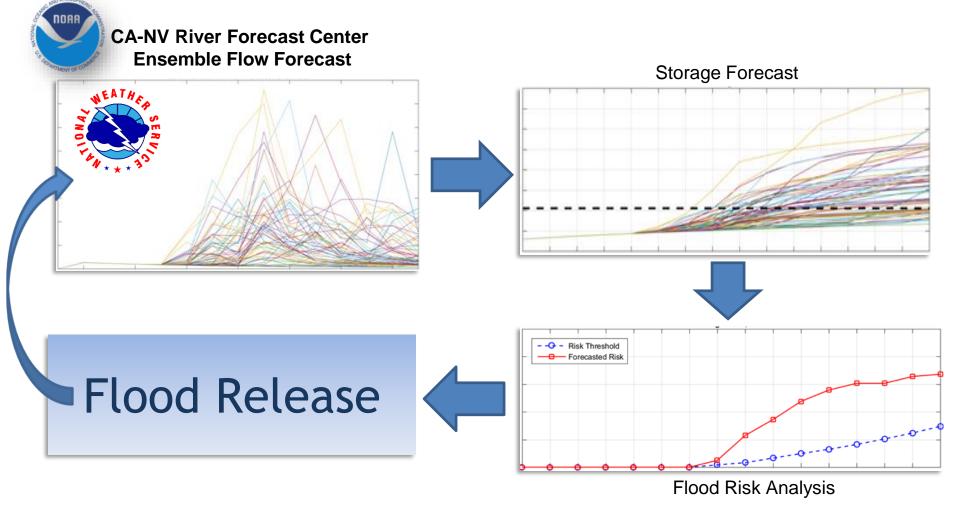


Hybrid 2 February 16



Forecasted Risk Risk Thresh 1 - Risk Thresh 2 _ Forecast Risk Thresh 1 Forecast Risk Thresh 2 Risk (%) Forecast Day

Ensemble Forecast Operations (EFO)



Process repeated each time step