BUREAU OF RECLAMATION

CRFS 2021 Fall Meeting

LC Basin Region Operations Update

Boulder Canyon Operations Office

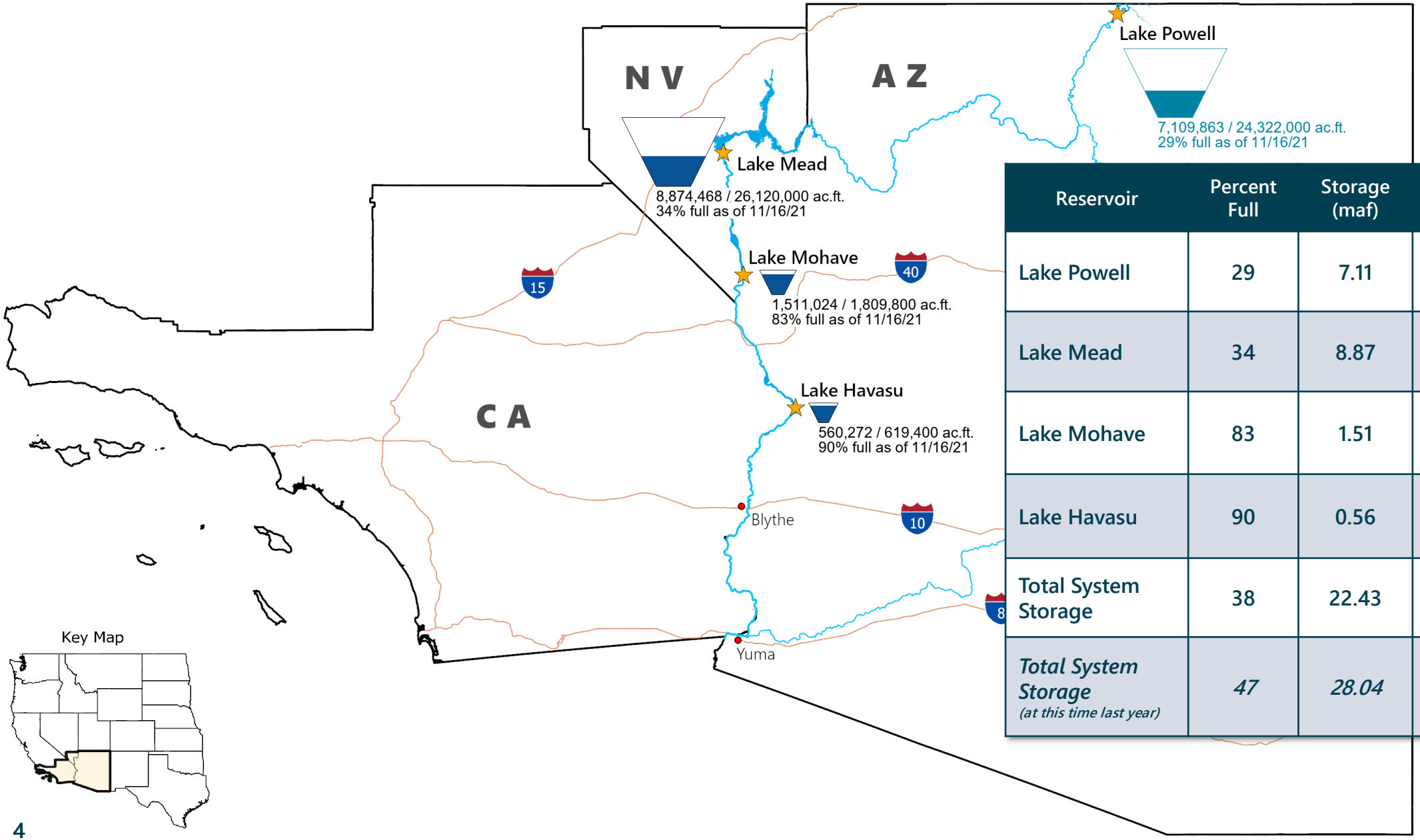
November 18, 2021

Overview

- Current Conditions & 2021 Operations
- 2022 Projected Operations

Lower Colorado River Basin
Current Conditions

Lower Colorado Basin System Conditions (as of November 16, 2021)



Reservoir	Percent Full	Storage (maf)	Elevation (feet)
Lake Powell	29	7.11	3,543.22
Lake Mead	34	8.87	1,065.87
Lake Mohave	83	1.51	635.97
Lake Havasu	90	0.56	446.96
Total System Storage	38	22.43	-
Total System Storage *(at this time last year)*	*47*	*28.04*	-

Lower Basin Side Inflows – WY/CY 2021[1,2]

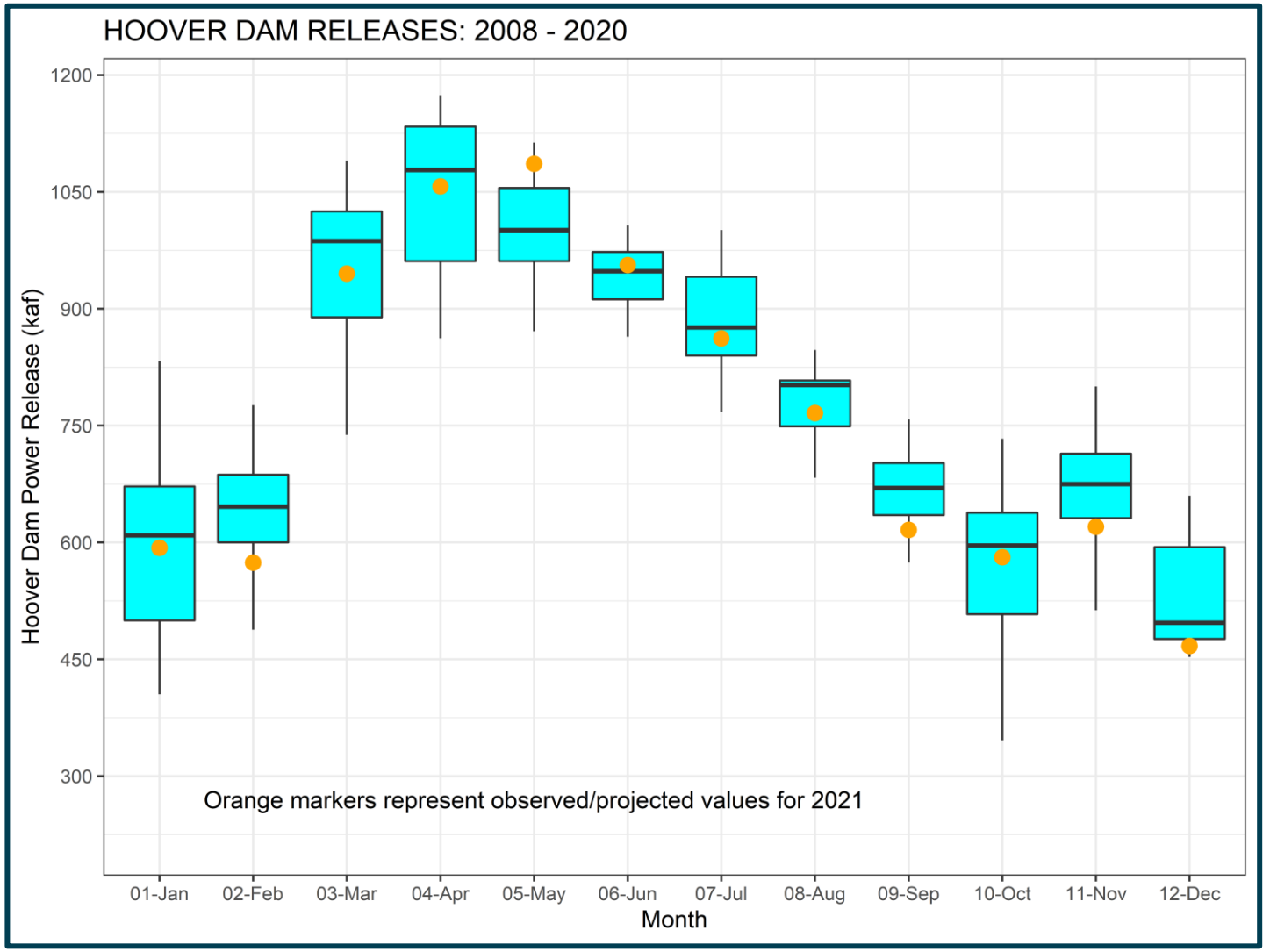
Intervening Flow from Glen Canyon to Hoover Dam

Month in WY/CY 2021		5-Year Average Intervening Flow (kaf)	Observed Intervening Flow (kaf)	Observed Intervening Flow (% of Average)	Difference From 5-Year Average (kaf)
Observed	October 2020	58	35	60%	-23
	November 2020	71	56	79%	-15
	December 2020	67	59	88%	-8
	January 2021	95	72	75%	-23
	February 2021	97	55	57%	-42
	March 2021	111	33	30%	-78
	April 2021	81	36	45%	-45
	May 2021	50	28	55%	-23
	June 2021	29	-14	-48%	-43
	July 2021	64	95	148%	31
	August 2021	81	89	110%	8
	September 2021	71	50	70%	-21
	October 2021	58	81	139%	23
Future	November 2021	71			
	December 2021	67			
	WY 2021 Totals	876	593	68%	-283
	CY 2021 Totals	876	663	76%	-214

[1] Values were computed with the LC's gain-loss model for the most recent 24-month study.

[2] Percents of average are based on the 5-year mean from 2016-2020.

Lower Basin Region Dam Releases



EXPLANATION

Largest value within 1.5 times interquartile range above 75th percentile

75th percentile

Interquartile range

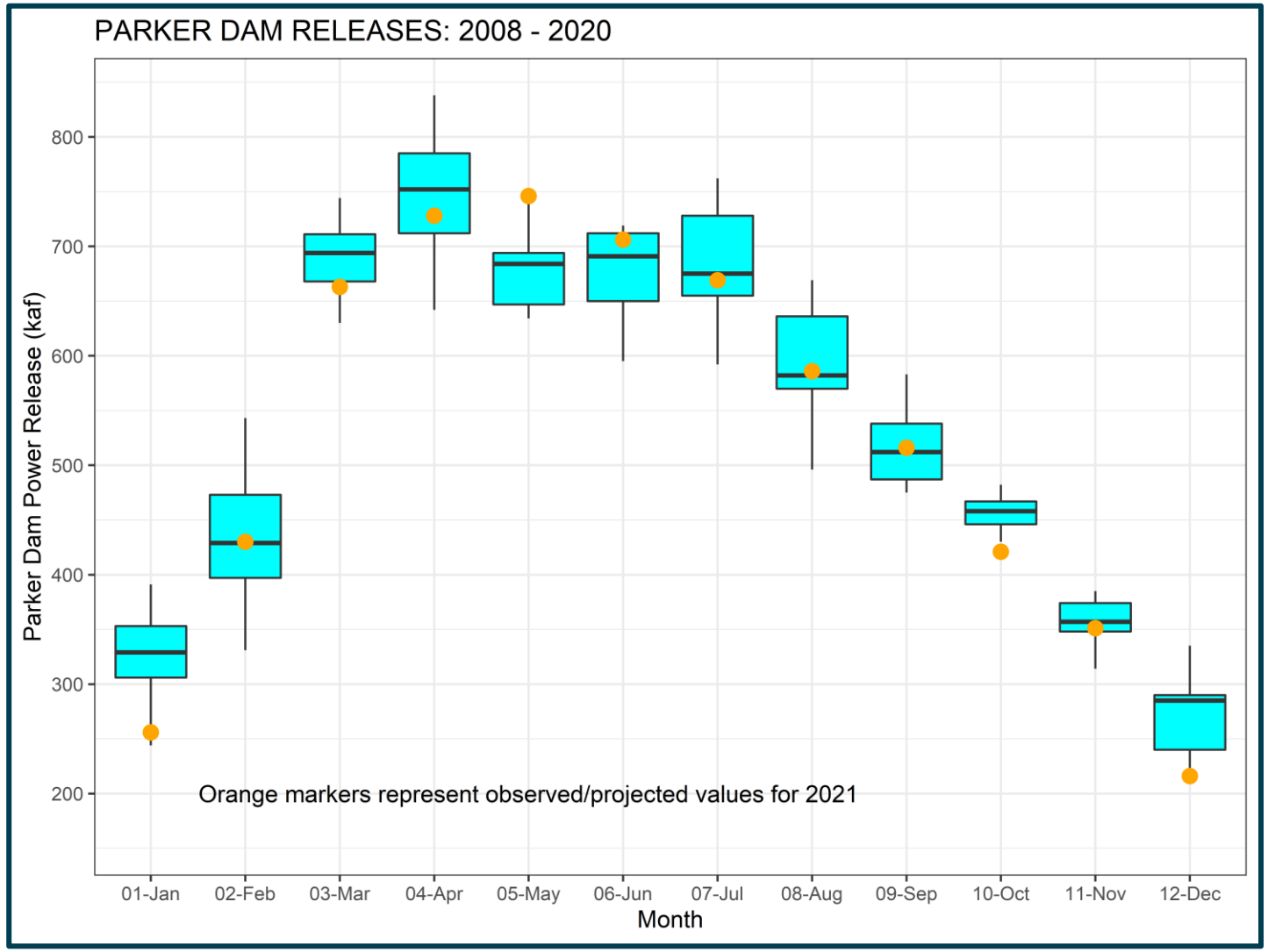
50th percentile (median)

25th percentile

Smallest value within 1.5 times interquartile range below 25th percentile

- **Outside value**Value is >1.5 times and <3 times the interquartile range beyond either end of the box

Lower Basin Region Dam Releases



EXPLANATION

Largest value within 1.5 times interquartile range above 75th percentile

75th percentile

50th percentile (median)

25th percentile

Interquartile range

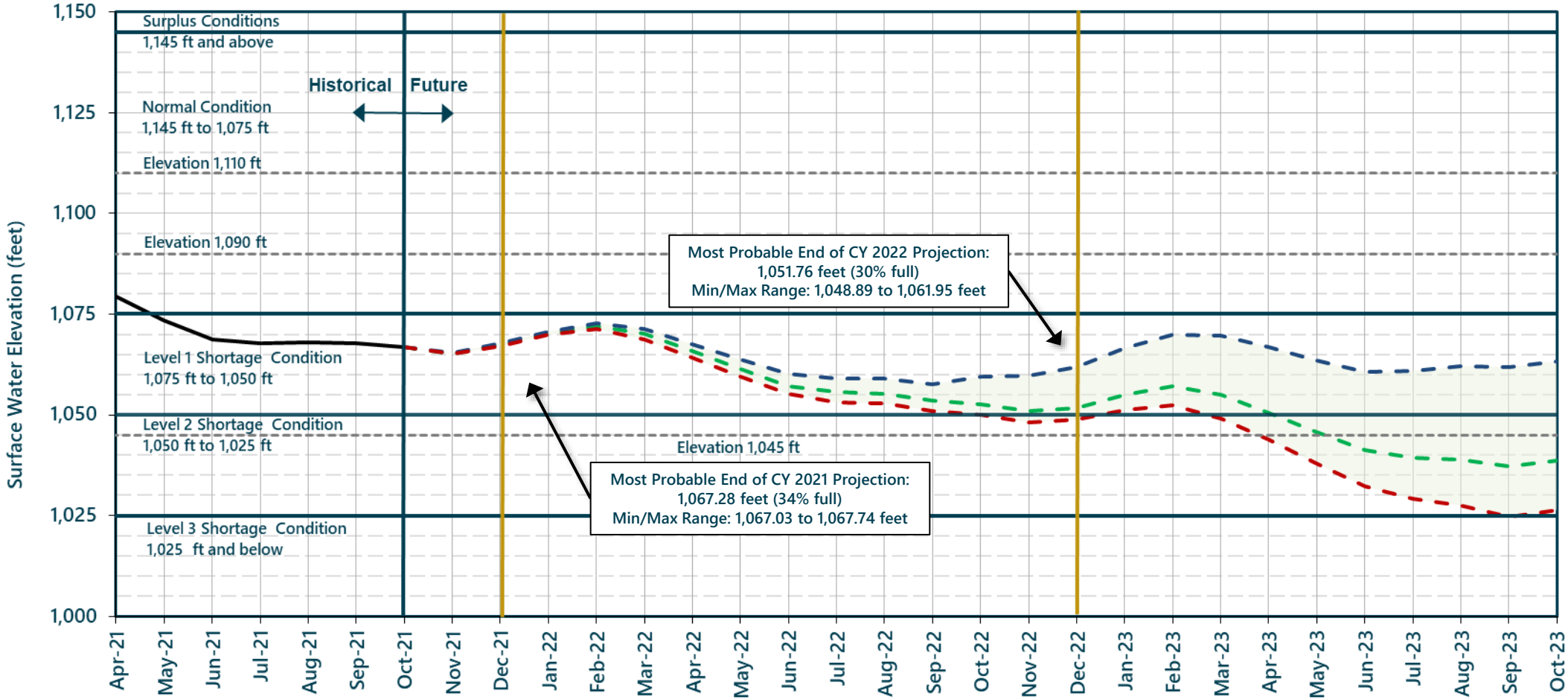
Smallest value within 1.5 times interquartile range below 25th percentile

- **Outside value**Value is >1.5 times and <3 times the interquartile range beyond either end of the box

Lower Colorado River Basin Operations Update

Lake Mead End of Month Elevations

Projections from the November 2021 24-Month Study Inflow Scenarios



Historical Elevations

November 2021 Most Probable Inflow with a Lake Powell release of 7.48 maf in WY 2022 and WY 2023

November 2021 DROA Maximum Probable Inflow with a Lake Powell release of 7.48 maf in WY 2022 and 9.00 maf in WY 2023

November 2021 DROA Minimum Probable Inflow with a Lake Powell release of 7.48 maf in WY 2022 and 7.00 maf in WY 2023

The Drought Response Operations Agreement (DROA) is available online at: https://www.usbr.gov/dcp/finaldocs.html.

Projected Lake Mead Operational Tiers

Based on 24-Month Study Inflow Scenarios

Inflow Scenario	CY 2022 Operating Condition	CY 2023 Jan 1, 2023 Projections
Nov Probable Maximum	Tier 1 Shortage Condition[1] + Water Savings Contributions[2]	Tier 1 Shortage Condition + Water Savings Contributions[2] Elevation 1,061.95 ft
Nov Most Probable		Tier 1 Shortage Condition + Water Savings Contributions[2] Elevation 1,051.76 ft
Nov Probable Minimum		Tier 2 Shortage Condition + Water Savings Contributions[2] Elevation 1,048.89 ft

[1]The 2022 operating tier was determined with the August 2021 Most Probable 24-Month Study and is documented in the draft 2022 AOP.

[2]Water savings contributions consistent with the 2019 Colorado River Drought Contingency Plans and Section IV of IBWC Minute No. 323.

2007 Interim Guidelines, Minute 323, Lower Basin Drought Contingency Plan, and Binational Water Scarcity Contingency Plan

Total Volumes (kaf)

Lake Mead Elevation (feet msl)	2007 Interim Guidelines Shortages		Minute 323 Delivery Reductions	Total Combined Reductions	DCP Water Savings Contributions			Binational Water Scarcity Contingency Plan Savings	Combined Volumes by Country *US: (2007 Interim Guidelines Shortages + DCP Contributions)* *Mexico: (Minute 323 Delivery Reductions + Binational Water Scarcity Contingency Plan Savings)*					Total Combined Volumes
	AZ	NV	Mexico	***Lower Basin States + Mexico***	AZ	NV	CA	Mexico	*AZ Total*	*NV Total*	*CA Total*	*Lower Basin States Total*	*Mexico Total*	***Lower Basin States + Mexico***
1,090 - 1,075	0	0	0	***0***	192	8	0	41	192	8	0	*200*	*41*	***241***
1,075 - 1050	320	13	50	***383***	192	8	0	30	512	21	0	*533*	*80*	***613***
1,050 - 1,045	400	17	70	***487***	192	8	0	34	592	25	0	*617*	*104*	***721***
1,045 - 1,040	400	17	70	***487***	240	10	200	76	640	27	200	*867*	*146*	***1,013***
1,040 - 1,035	400	17	70	***487***	240	10	250	84	640	27	250	*917*	*154*	***1,071***
1,035 - 1,030	400	17	70	***487***	240	10	300	92	640	27	300	*967*	*162*	***1,129***
1,030 - 1,025	400	17	70	***487***	240	10	350	101	640	27	350	*1,017*	*171*	***1,188***
<1,025	480	20	125	***625***	240	10	350	150	720	30	350	*1,100*	*275*	***1,375***

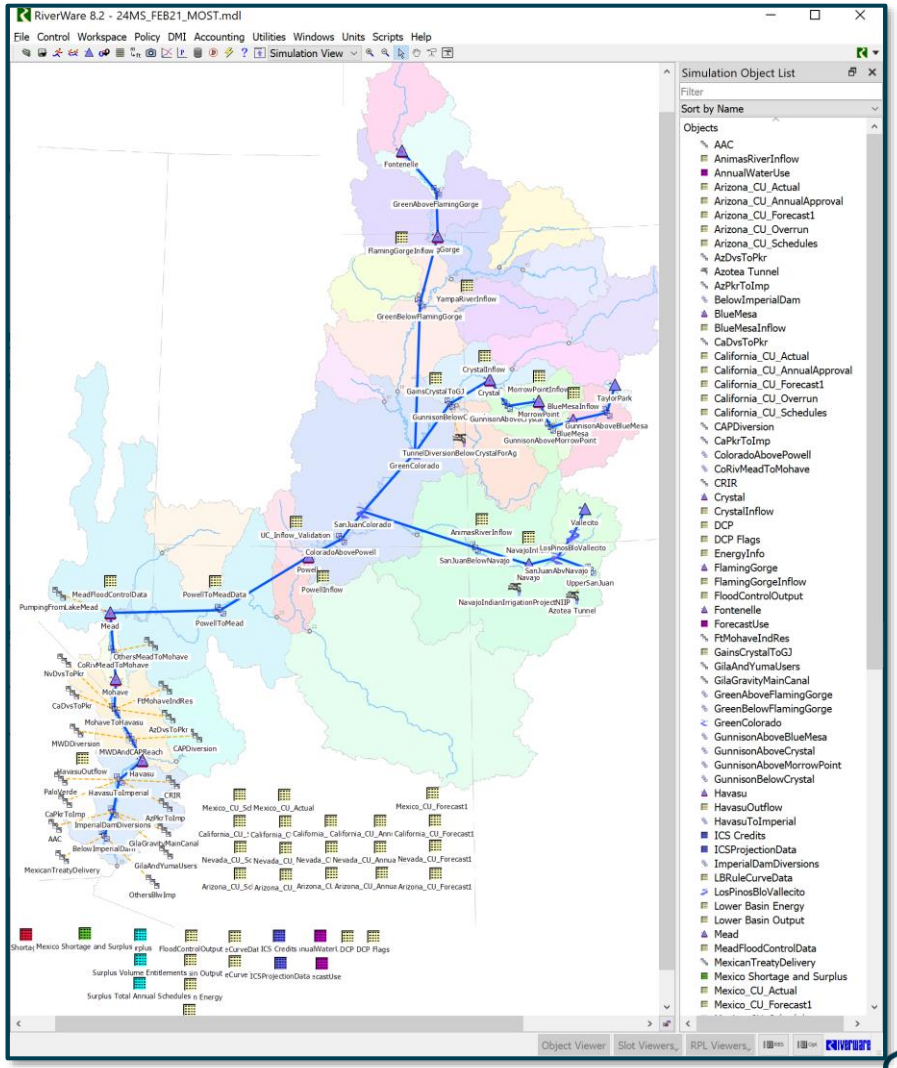
2022 Reductions + Contributions

2022 Reductions + Contributions

The Secretary of the Interior will take affirmative actions to implement programs designed to create or conserve 100,000 acre-ft per annum or more of Colorado River System water to contribute to conservation of water supplies in Lake Mead and other Colorado River reservoirs in the lower basin. All actions taken by the United States shall be subject to applicable law, including availability of appropriations.

Colorado River Mid-Term Modeling System (CRMMS)

- Simulate basin-wide operations
  - RiverWare™ based simulation models
  - 12 major reservoirs
  - 2+ year projections, updated monthly
- Project monthly reservoir conditions based on:
  - Unregulated inflow forecasts from CBRFC
  - Lower Basin water orders
- Operations consistent with the 2007 Interim Guidelines, Minute 323 and the Lower Basin DCP
  - Does not include assumptions for UB Drought Response Operations beyond 2021

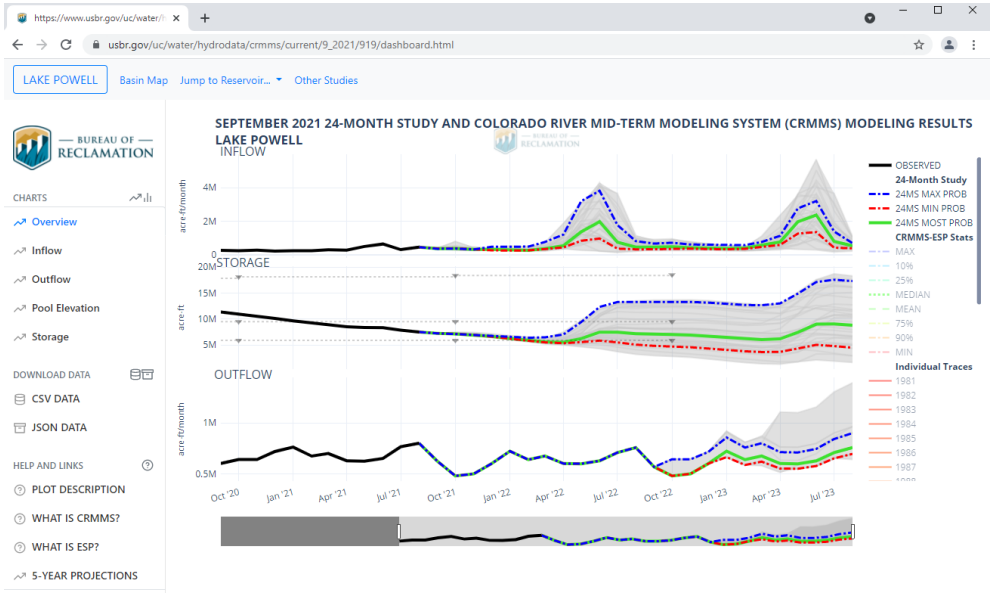


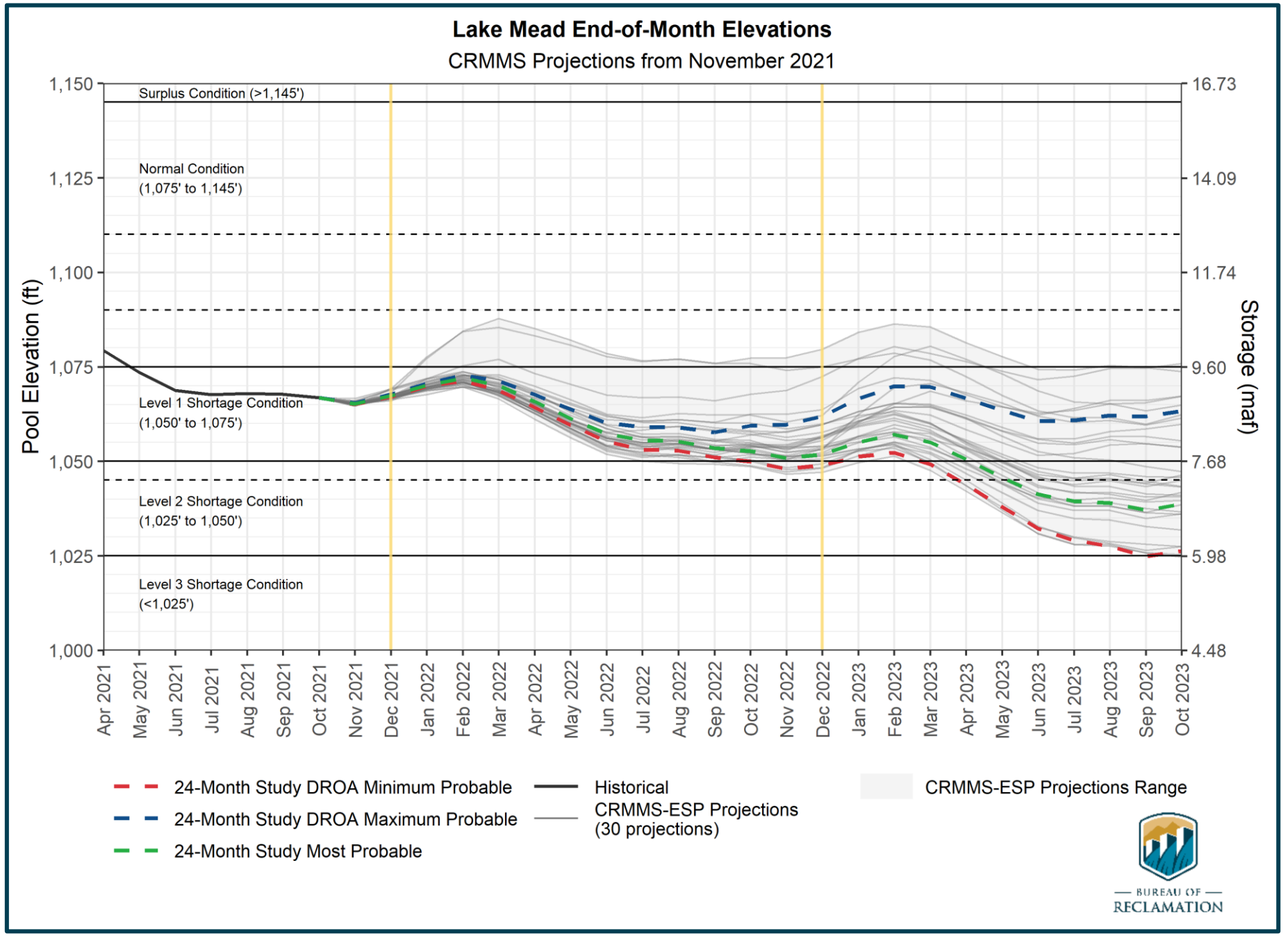
Reclamation Operational Modeling
Model Comparison

	Colorado River Mid-term Modeling System (CRMMS)		*CRSS*
	24-Month Study Mode *(Manual Mode)*	Ensemble Mode *(Rule-based Mode)*	
Primary Use	AOP tier determinations and projections of current conditions	Risk-based operational planning and analysis	Long-term planning, comparison of alternatives
Simulated Reservoir Operations	Operations input manually	Rule-driven operations	
Probabilistic or Deterministic	Deterministic – single hydrologic trace	Deterministic OR Probabilistic 30 (or more) hydrologic traces	Probabilistic – 100+ traces
Time Horizon (years)	1 - 2	1 - 5	1 - 50
Upper Basin Inflow	Unregulated forecast, 1 trace	Unregulated ESP forecast (30+ traces)	Natural flow; historical, paleo, or climate change hydrology
Upper Basin Demands	Implicit, in unregulated inflow forecast		Explicit, 2016 UCRC assumptions
Lower Basin Demands	Official approved or operational		Developed with LB users

New Approach - Making 2-Year Probabilistic Projections Available

- CRSS will continue to be published 2-3 times per year
- CRMMS 2-year results will be published on a monthly basis
  - Deterministic 24-Month Study and Probabilistic ESP model runs
- Online Visualization Suite
  - Visualize and Download Data
    - Storage, Inflow, Outflow, Pool Elevation
  - Map Based Navigation
    - All CRSP and LCB Mainstem Reservoirs
  - Modern Interactive Interface
    - Optimized for Chrome/Firefox
  - Current and previous runs will be available





CRMMS 2-Year Probabilistic Projections are available online at: https://www.usbr.gov/lc/region/g4000/riverops/crmms-2year-projections.html

Lower Colorado River Operations

For further information: https://www.usbr.gov/lc/riverops.html

Email: bcoowaterops@usbr.gov

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