



— BUREAU OF —
RECLAMATION

GCDAMP Technical Management Work Group

Basin Hydrology, Operations and Water Quality

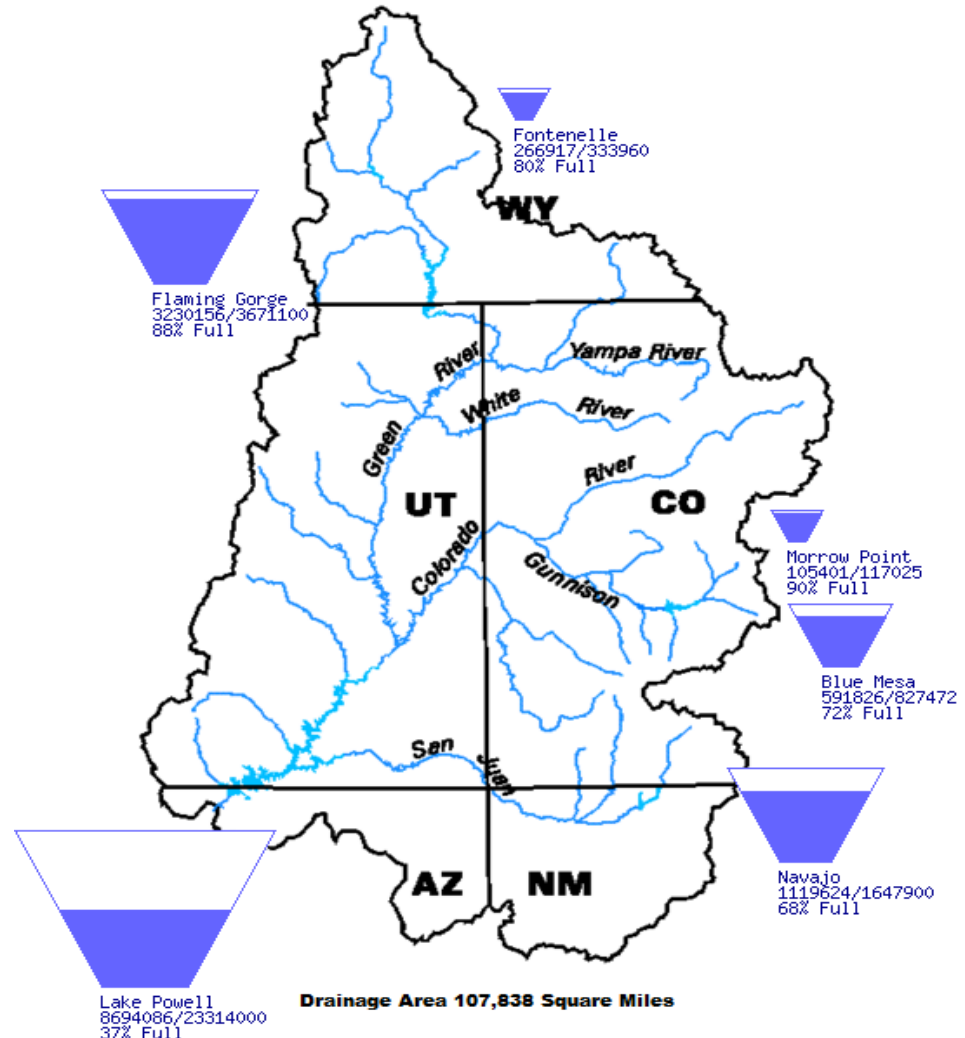
November 7, 2023

Upper Basin Storage (as of November 5, 2023)

Data Current as of:
11/05/2023

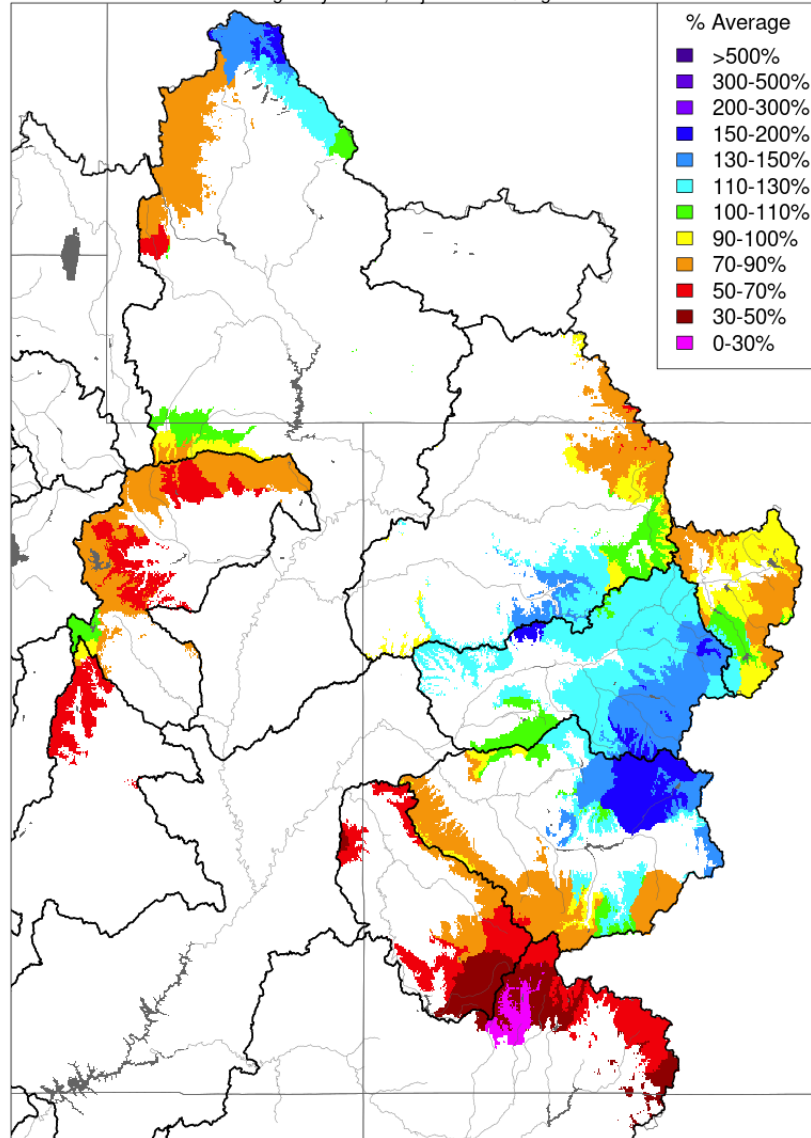
Upper Colorado River Drainage Basin

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	80	0.27	0.33	6,497.07
Flaming Gorge	88	3.23	3.67	6,029.09
Blue Mesa	72	0.59	0.83	7,491.80
Navajo	68	1.12	1.65	6,045.46
Lake Powell	37	8.69	23.31	3,572.32
UC System Storage	47	14.02	29.79	
Total System Storage	43	24.94	58.48	



Water Year Precipitation, October 2023 - October 2023

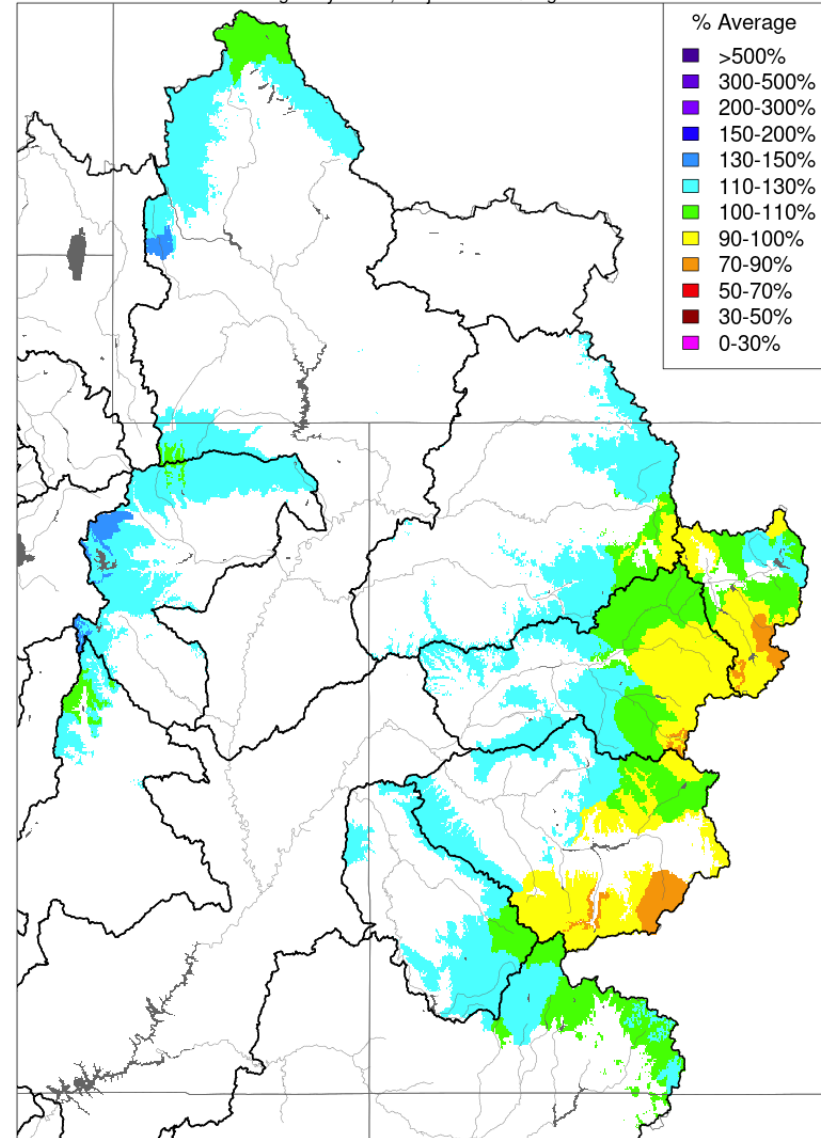
Averaged by Basin, Major Contributing Areas



Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

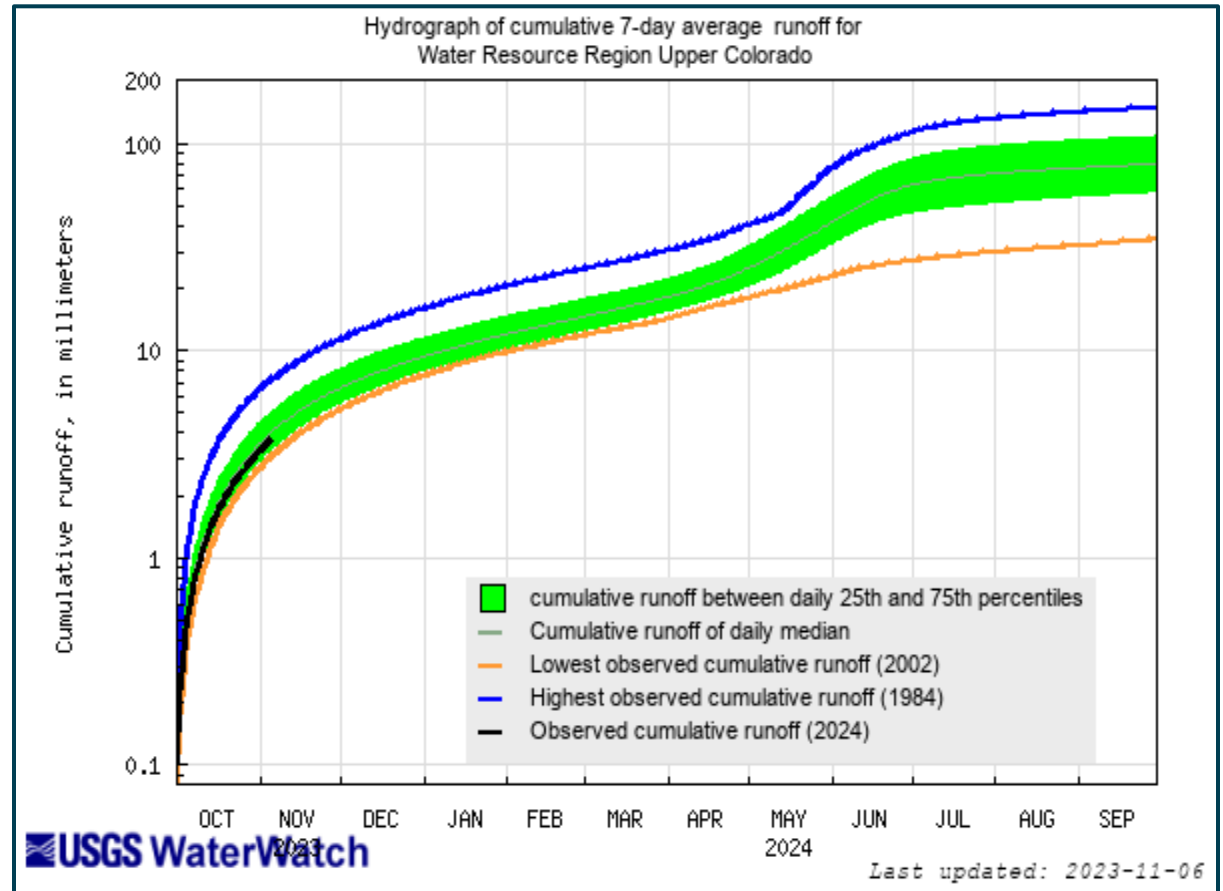
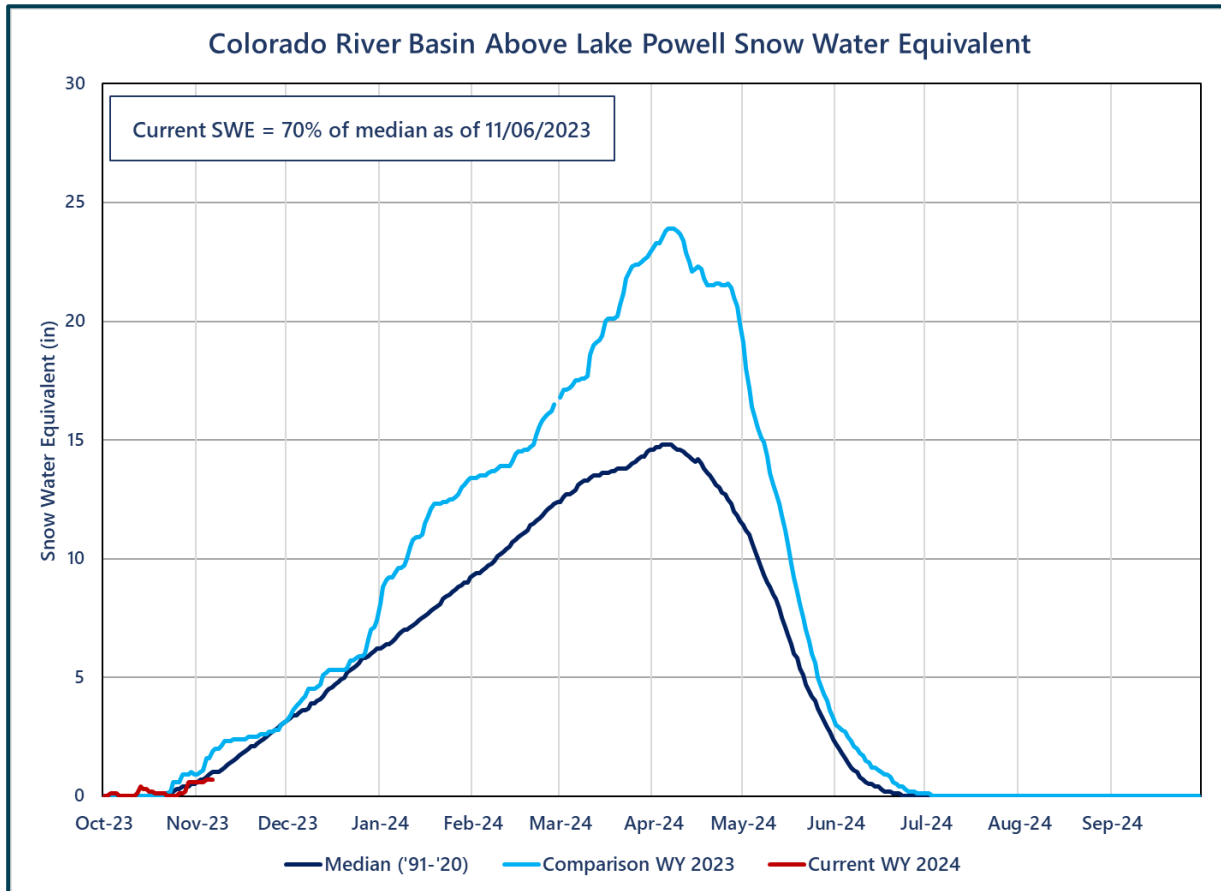
Water Year Precipitation, October 2022 - September 2023

Averaged by Basin, Major Contributing Areas



Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

Upper Colorado SWE and Observed Inflows



<https://waterwatch.usgs.gov/index.php>



Observed Water Year 2023

April – July 2023
Observed Unregulated Inflow
as of October 1, 2023

Reservoir	Inflow (kaf)	Percent of Avg ¹
Fontenelle	951	129
Flaming Gorge	1,457	151
Blue Mesa	833	131
Navajo	1,028	163
Powell	10,619	166

Water Year 2023
Unregulated Inflow Forecast
as of October 1, 2023

Reservoir	Inflow (kaf)	Percent of Avg ¹
Fontenelle	1,266	118
Flaming Gorge	1,847	131
Blue Mesa	1,060	117
Navajo	1,218	134
Powell	13,421	140

¹Averages are based on the 1991 through 2020 period of record.



Most Probable November Forecast Water Year 2024

April – July 2024
Forecasted Unregulated Inflow
as of November 1, 2023

Reservoir	Inflow (kaf)	Change from October	Percent of Avg ¹
Fontenelle	655	-30	89
Flaming Gorge	855	-70	89
Blue Mesa	595	0	94
Navajo	479	-40	76
Powell	5,700	-535	89

Water Year 2024
Unregulated Inflow Forecast
as of November 1, 2023

Reservoir	Inflow (kaf)	Change from October	Percent of Avg ¹
Fontenelle	998	-27	93
Flaming Gorge	1,329	-9	94
Blue Mesa	841	-4	93
Navajo	668	-92	73
Powell	8,624	-776	90

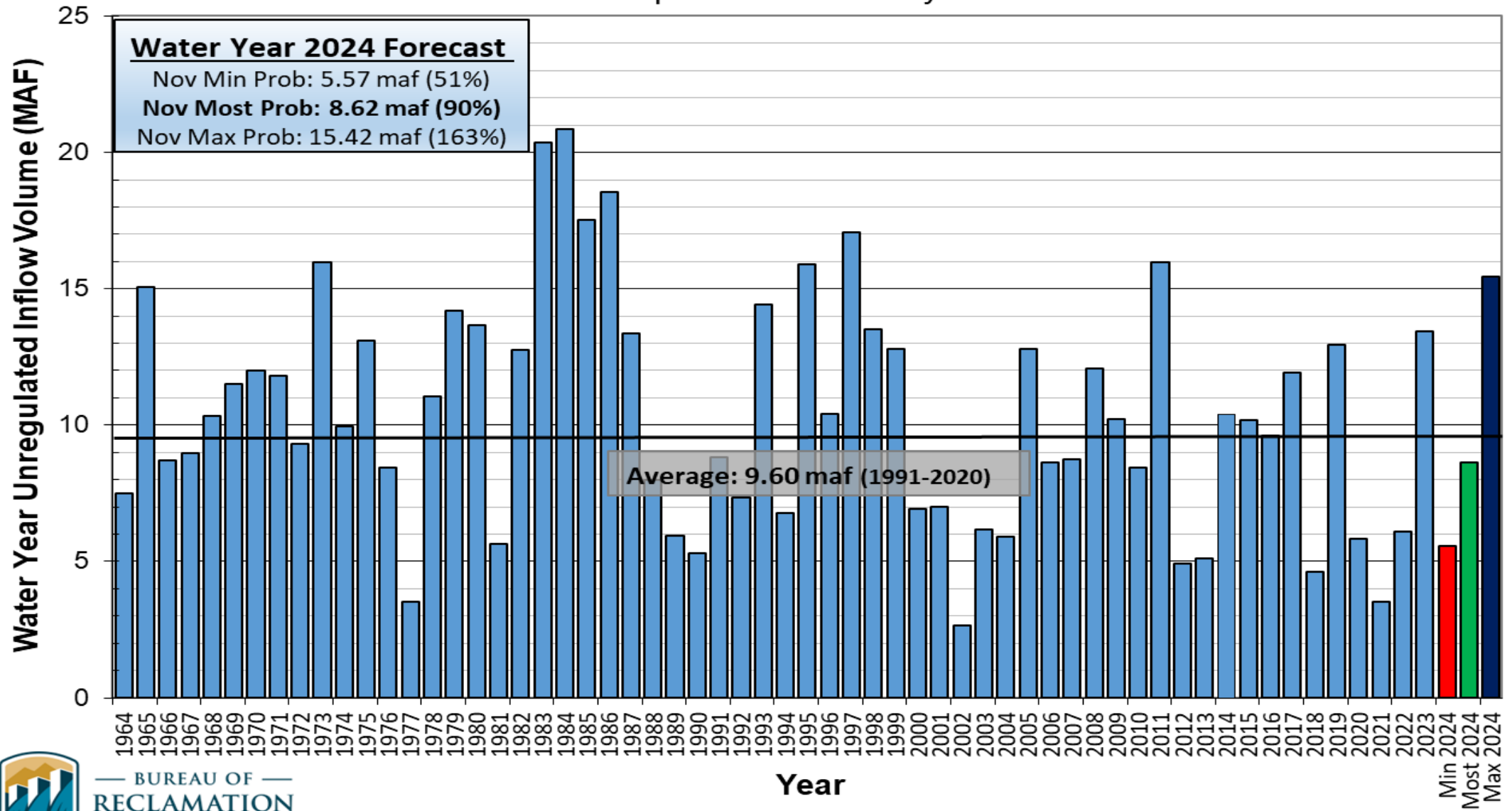
¹Averages are based on the 1991 through 2020 period of record.



Lake Powell Unregulated Inflow

Water Year 2024 Forecast *(issued November 1)*

Comparison with History



BUREAU OF RECLAMATION





Upper Colorado Basin

Hydrology and Operations
Projections Based on
October 2023 24-Month
Study



Upper Basin Reservoir Operations

Water Year 2024

- Lake Powell will be operated consistent with the 2007 Interim Guidelines, the Upper Basin Drought Response Operations Agreement and Upper Basin Records of Decision
- Lake Powell WY 2024 will operate in the Mid-Elevation Release Tier where Lake Powell will release 7.48 maf
- Reclamation will also ensure all appropriate consultation with Basin Tribes, the Republic of Mexico, other federal agencies, water users and non-governmental organizations with respect to implementation of these monthly and annual operations.



Drought Response Operations Agreement (DROA)

Completed DROA Volumes^{1,2}

Reservoir	2021 DROA Volume (kaf)	2022 DROA Volume (kaf)	2023 DROA Volume (kaf) ⁴	Total DROA Volume (kaf)
Flaming Gorge	125	328 ³	-224	229
Blue Mesa	36	0	-15	21
Navajo	0	0	0	0
Total DROA Volume (kaf)	161	328	-239	250

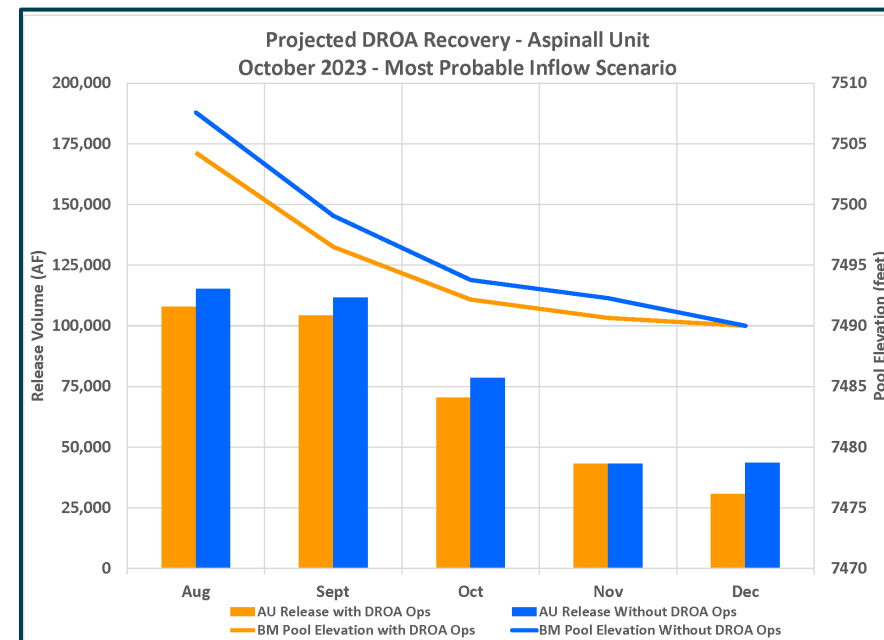
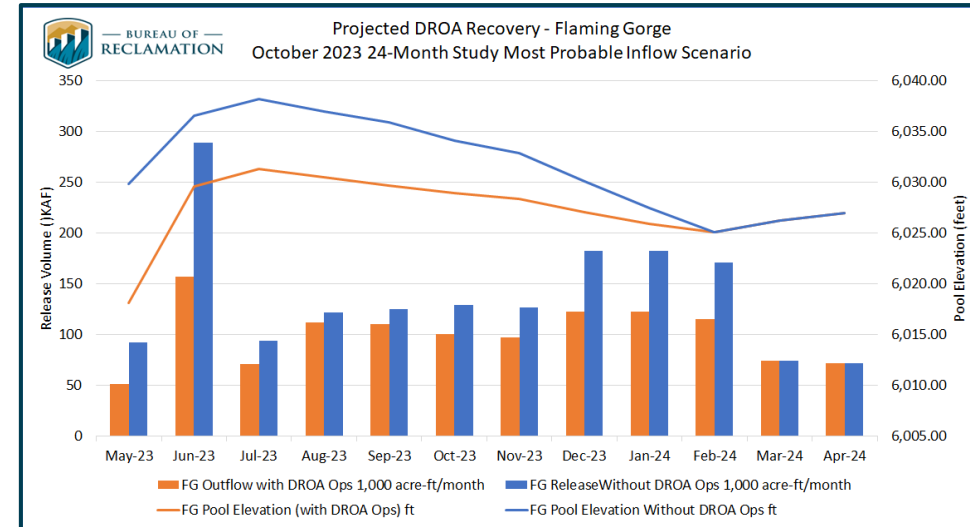
¹DROA operational year is from May through April.

²Positive values indicate Drought Response Operations Releases and negative values indicate Drought Response Operations Recovery

³ 463 kaf of DROA releases prior to DROA release suspension on March 6, 2023.

-135 kaf of DROA recovery from March 7, 2023 through April 30, 2023

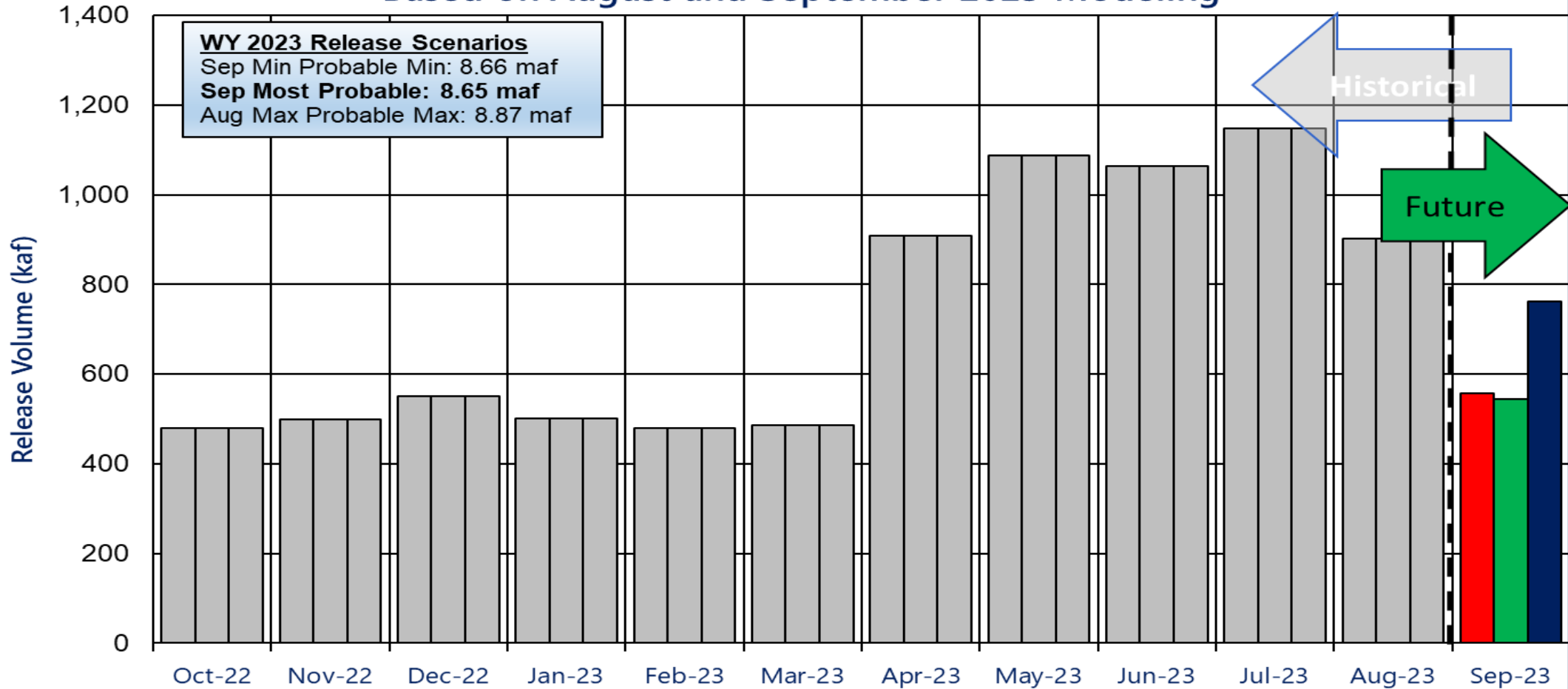
⁴DROA volumes through September 2023



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2023

Based on August and September 2023 Modeling

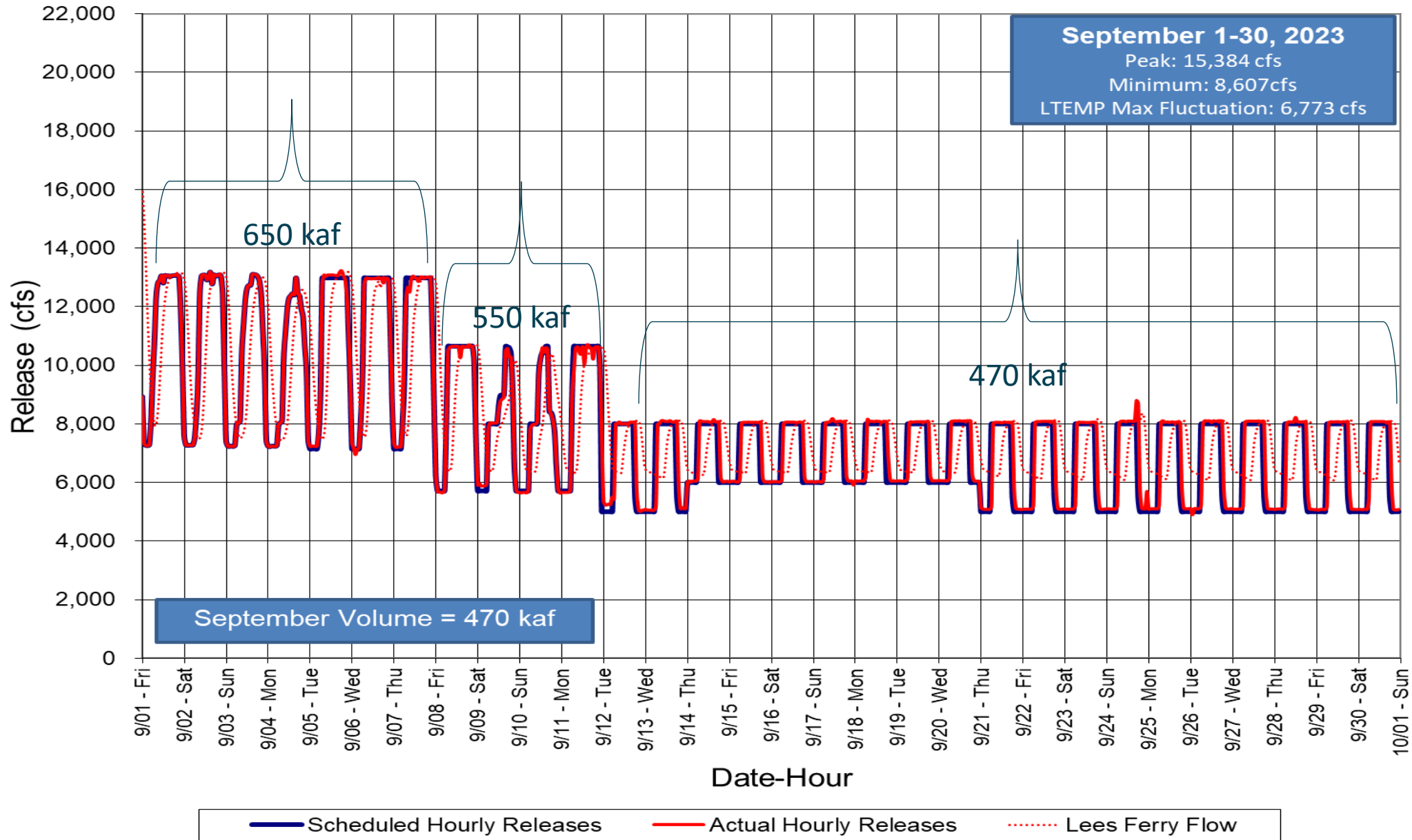


	10/1/2022	11/1/2022	12/1/2022	1/1/2023	2/1/2023	3/1/2023	4/1/2023	5/1/2023	6/1/2023	7/1/2023	8/1/2023	9/1/2023
■ Sept Min Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	556.675
■ Sept Most Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	543.552
■ Aug Max Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	761.938

■ Sept Min Probable ■ Sept Most Probable ■ Aug Max Probable



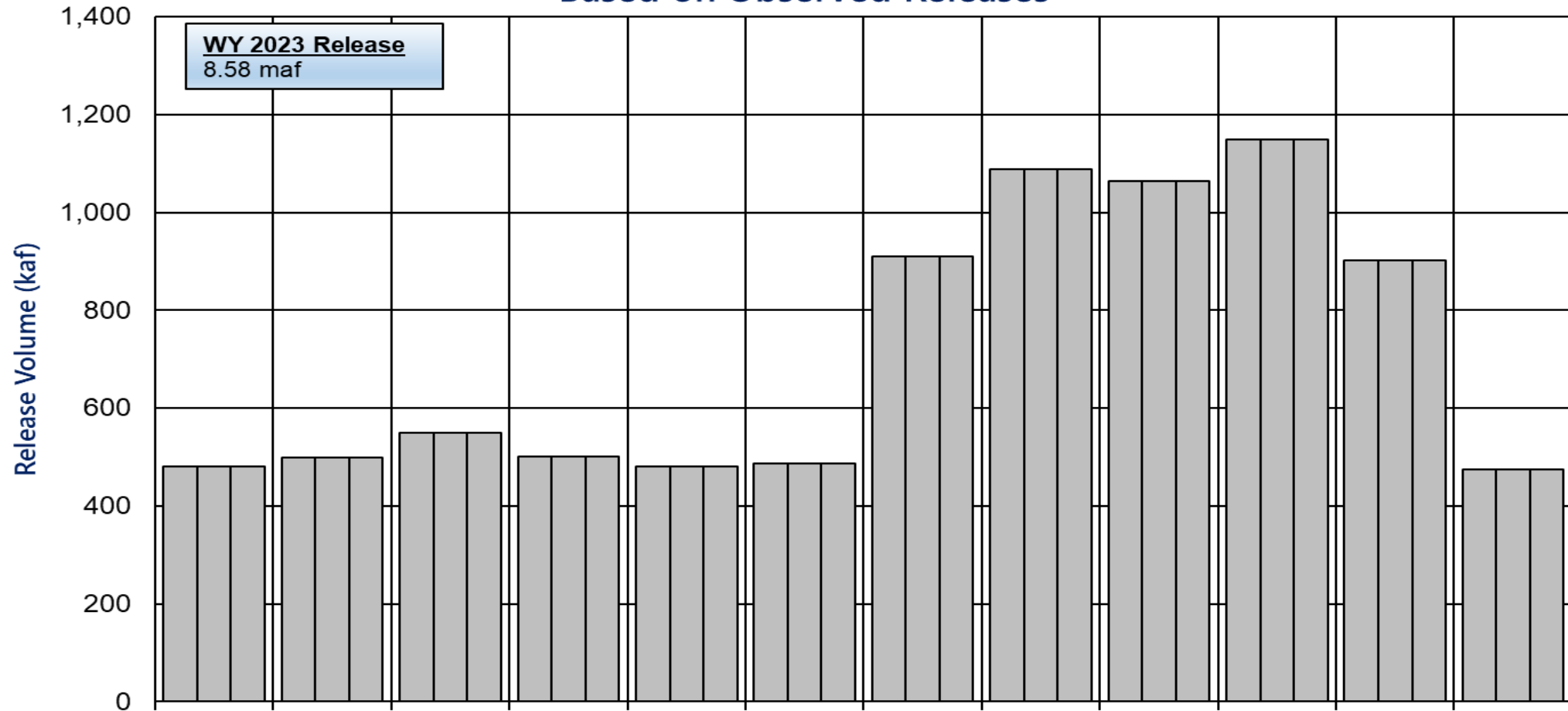
Glen Canyon Dam Hourly Release Pattern September 2023



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2023

Based on Observed Releases



	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
	10/1/2022	11/1/2022	12/1/2022	1/1/2023	2/1/2023	3/1/2023	4/1/2023	5/1/2023	6/1/2023	7/1/2023	8/1/2023	9/1/2023
■ Oct Min Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	473.710
■ Oct Most Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	473.710
■ Oct Max Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	473.710

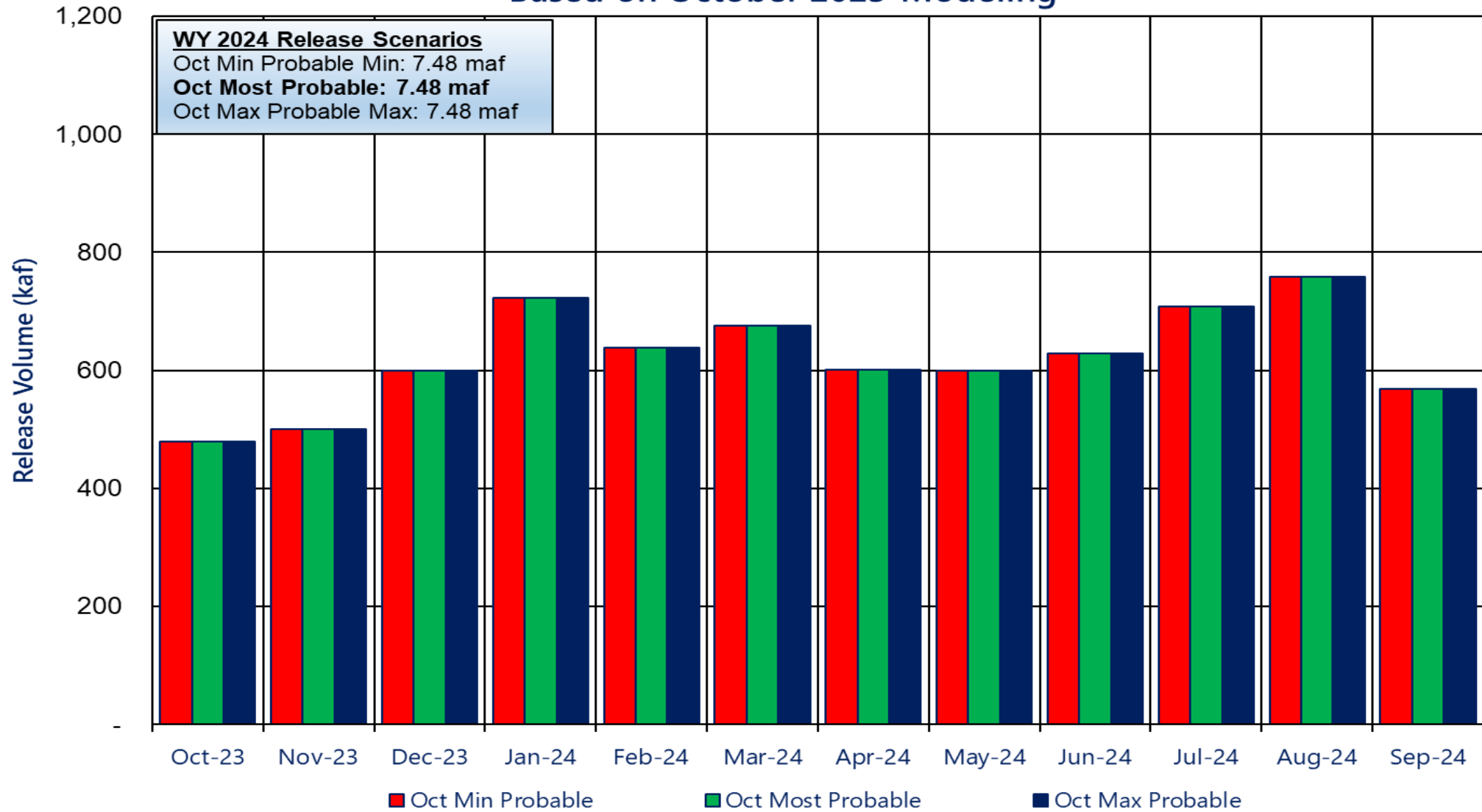
■ Oct Min Probable ■ Oct Most Probable ■ Oct Max Probable



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2024

Based on October 2023 Modeling

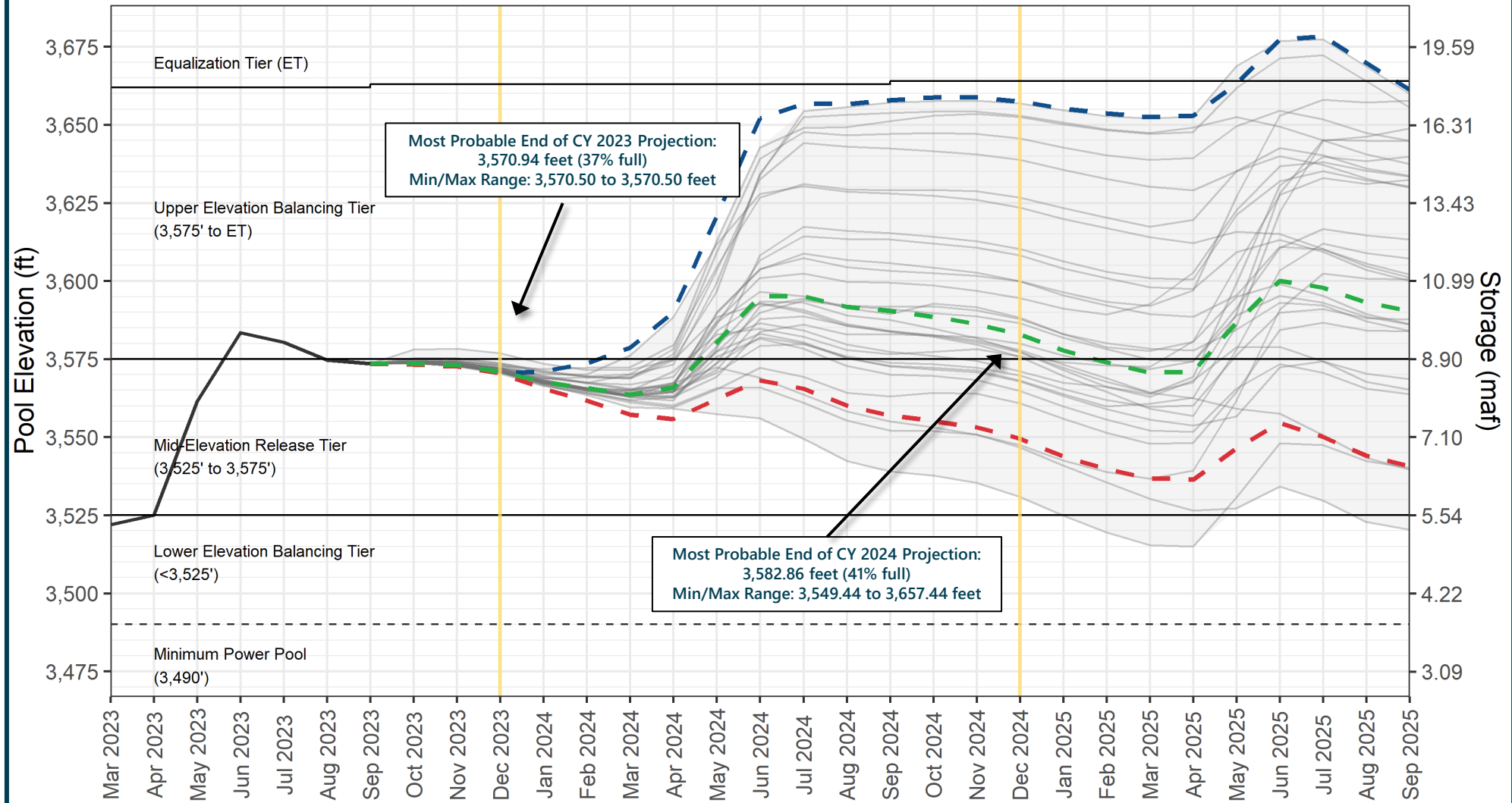


Reclamation Operational Modeling Model Comparison

	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



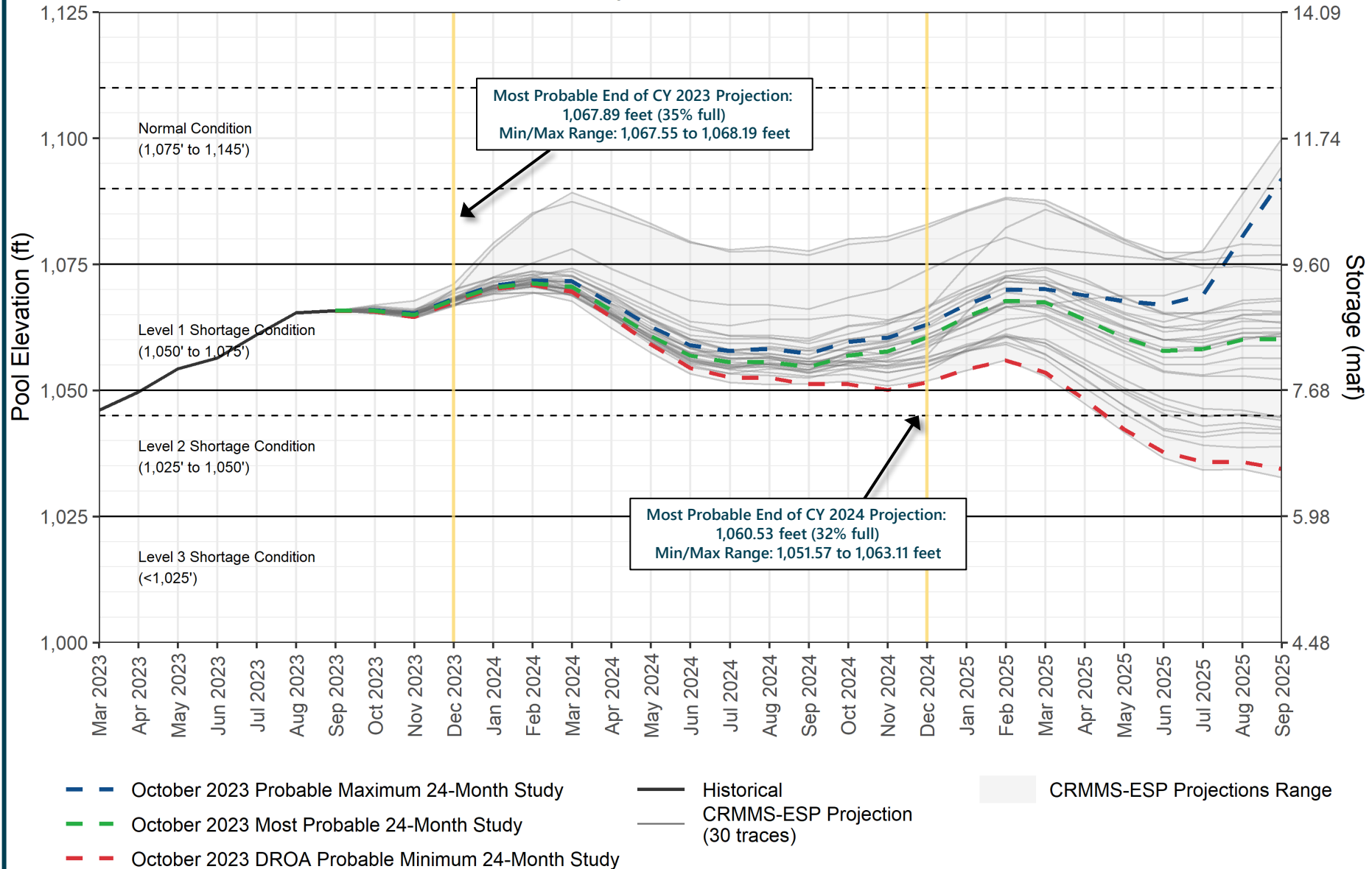
Lake Powell End-of-Month Elevations CRMMS Projections from October 2023



- October 2023 Probable Maximum 24-Month Study
- October 2023 Most Probable 24-Month Study
- October 2023 DROA Probable Minimum 24-Month Study
- Historical
- CRMMS-ESP Projection (30 traces)
- CRMMS-ESP Projections Range



Lake Mead End-of-Month Elevations CRMMS Projections from October 2023





Upper Colorado Basin

Hydropower Maintenance



Glen Canyon Dam Power Plant Unit Outage Schedule for 2024

Unit Number	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024
1	[Outage]								[Outage]			
2	[Outage]											
3	[Outage]											
4	[Outage]											
5								[Outage]				
6								[Outage]				
7						[Outage]						
8						[Outage]						
Units Available	4	4	6	6	6	6	5	5	7	8	8	8
Capacity (cfs)	12,400	12,400	19,550	19,450	19,300	19,350	12,200	16,100	23,800	23,800	27,300	27,300
Capacity (kaf/month)	770	1,030	1,200	1,190	1,150	1,230	1,080	1,130	1,410	1,670	1,680	1,620
Max (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568
Most (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568
Min (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568

OCT MOST²

OCT MOST

7.48 maf

7.48 maf

7.48 maf

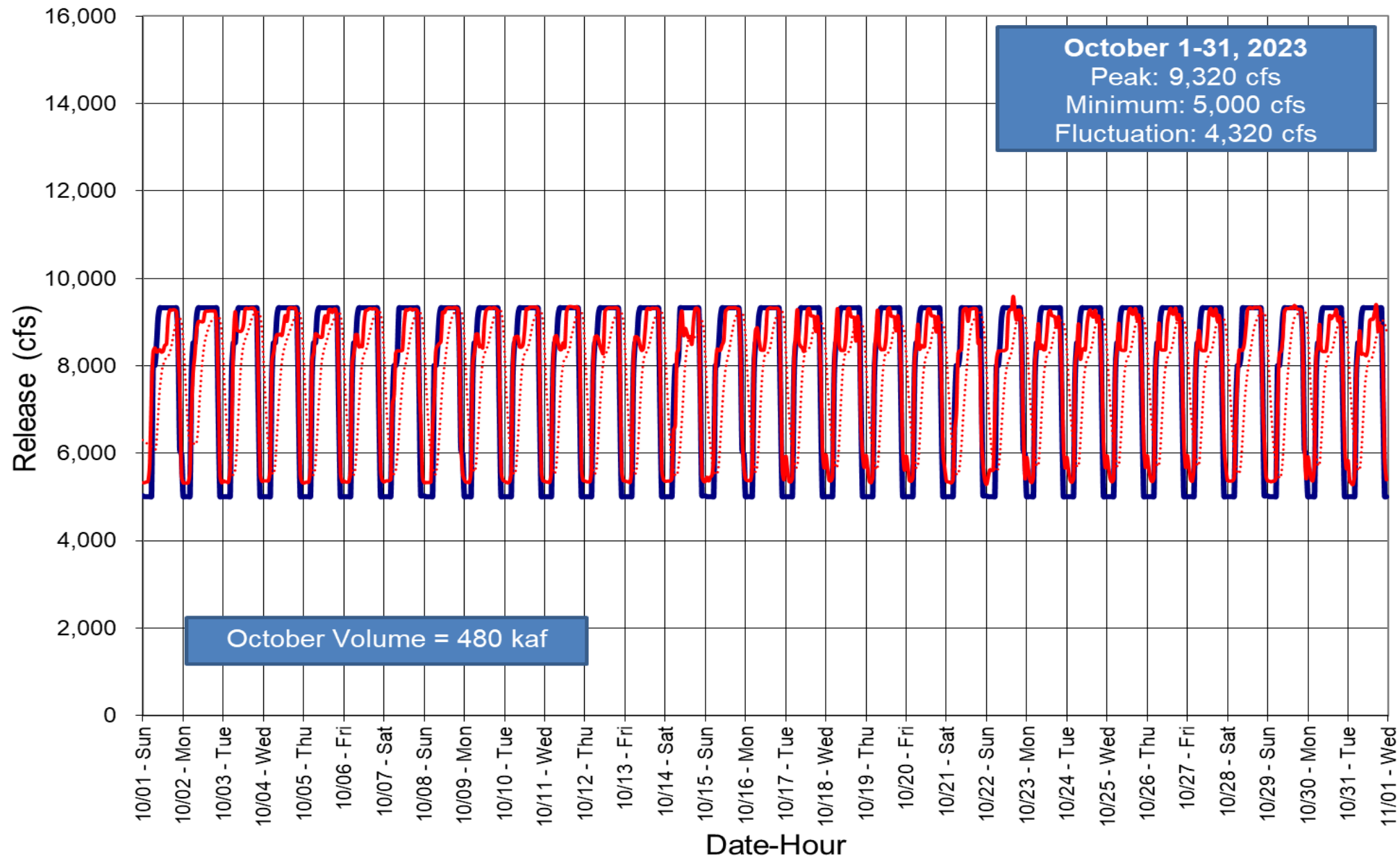
(updated 10-17-2023)

1 Projected release, based on October 2023 24MS for the minimum, most probable and maximum probable and 24-Month Study model runs.

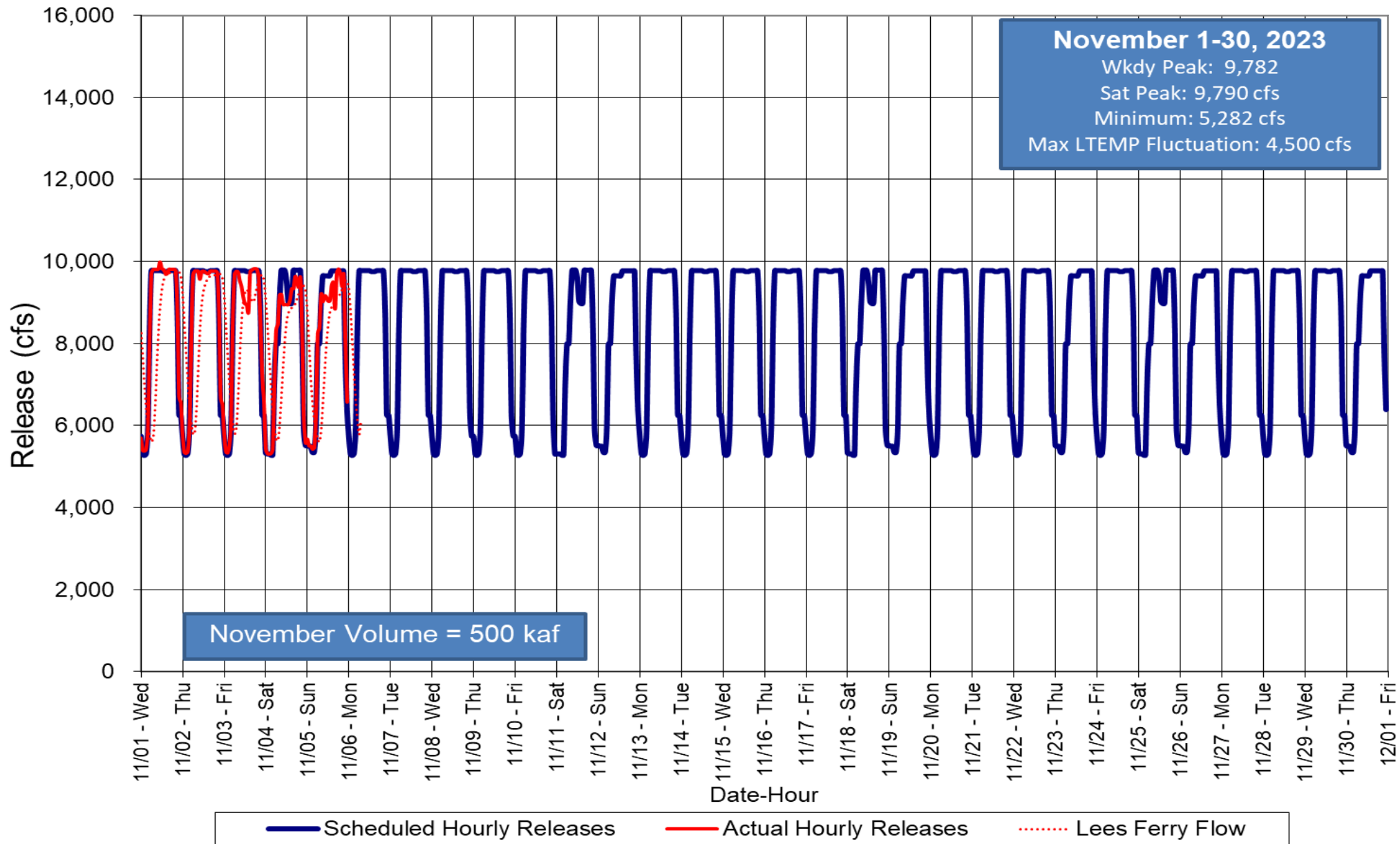
2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.



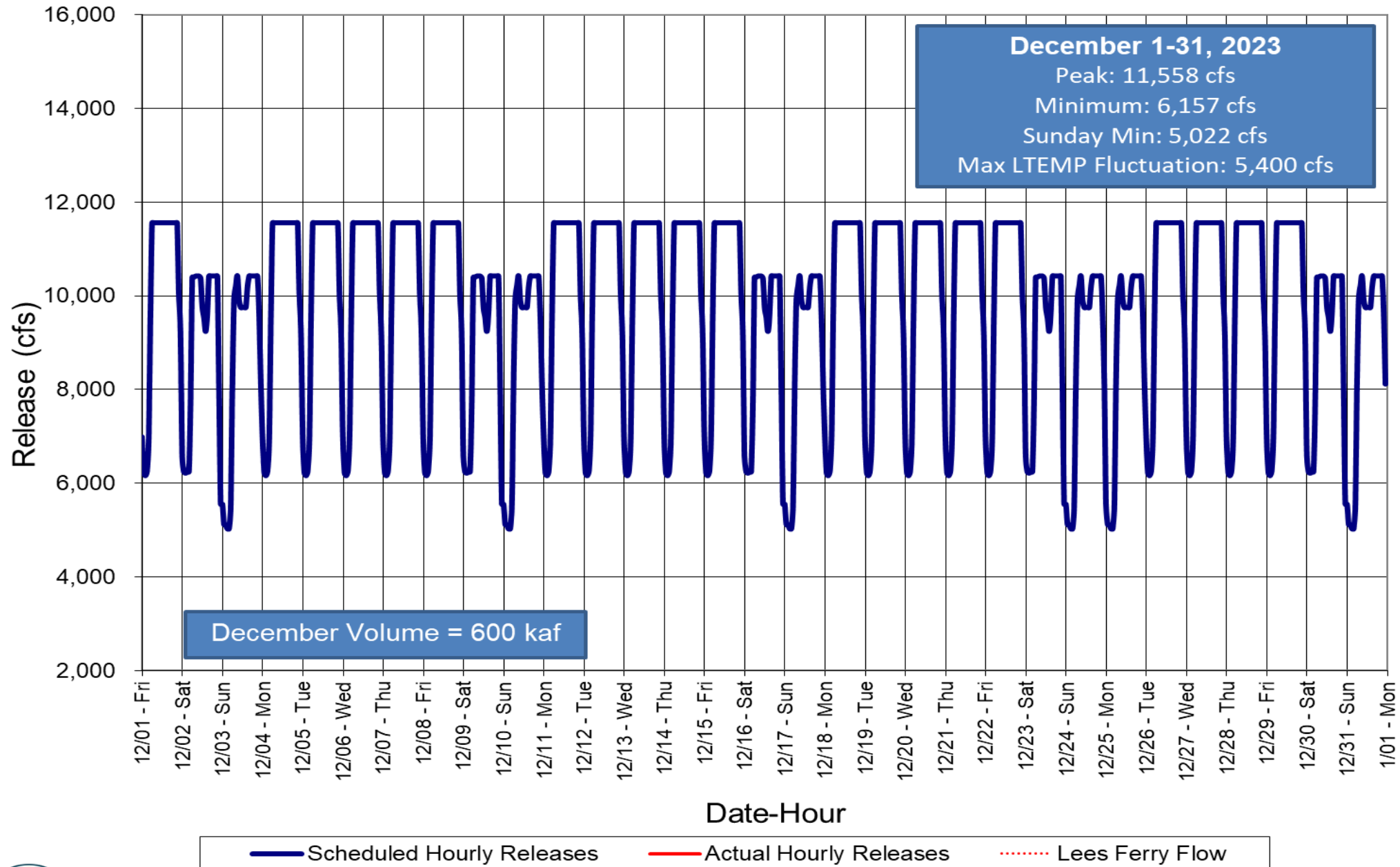
Glen Canyon Dam Hourly Release Pattern October 2023



Glen Canyon Dam Hourly Release Pattern November 2023



Glen Canyon Dam Hourly Release Pattern December 2023



Questions?



— BUREAU OF —
RECLAMATION