



— BUREAU OF —  
RECLAMATION

# Glen Canyon Monthly Operations Call

## Basin Hydrology and Operations

October 18, 2023

# Background

This briefing is being provided consistent with the provision in Attachment B - Section 1.1 of the LTEMP ROD which states:

“Annually, Reclamation will develop a hydrograph based on the characteristics above. Reclamation will seek consensus on the annual hydrograph through monthly operational coordination calls with governmental entities, and regular meetings of the GCDAMP Technical Working Group (TWG) and AMWG.

Reclamation will conduct monthly Glen Canyon Dam operational coordination meetings or calls with the DOI bureaus (USGS, NPS, FWS, and BIA), WAPA, and representatives from the Basin States and UCRC. The purpose of these meetings or calls is for the participants to share and seek information on Glen Canyon Dam operations. One liaison from each Basin State and from the UCRC may participate in the monthly operational coordination meetings or calls.”

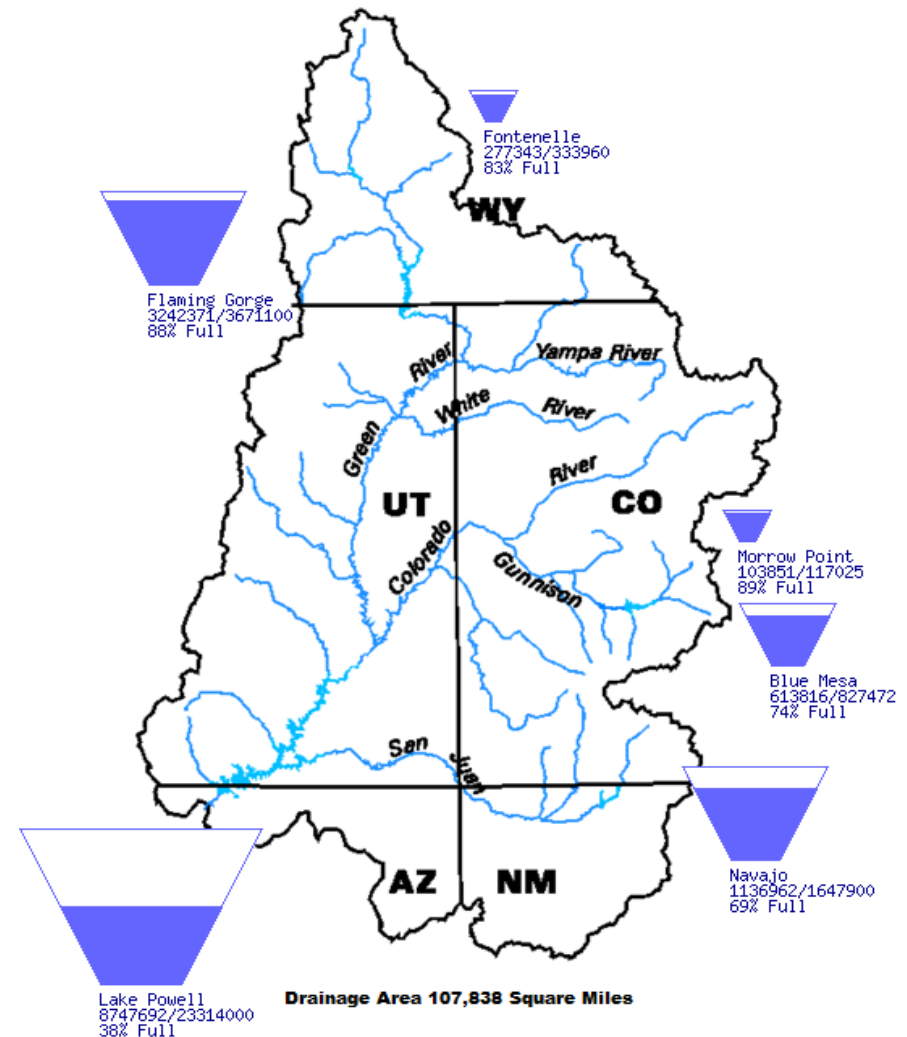


# Upper Basin Storage (as of October 15, 2023)

Data Current as of:  
10/15/2023

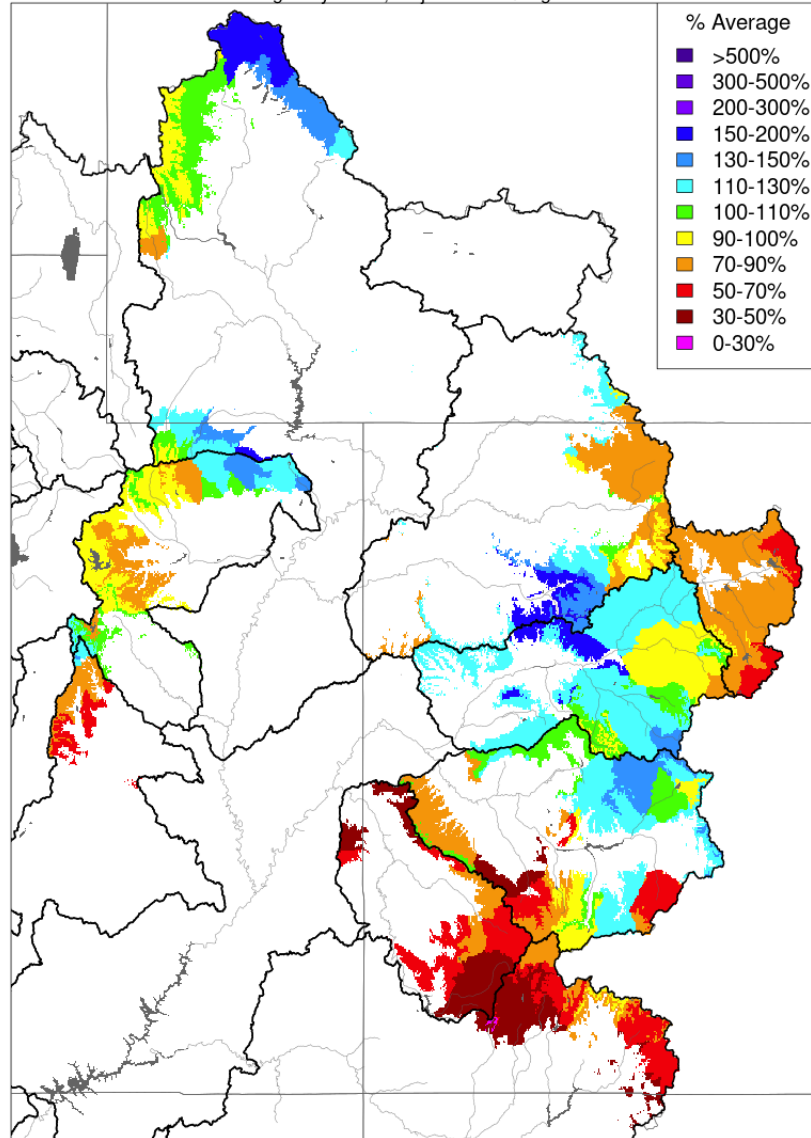
Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	83	0.28	0.33	6,498.51
Flaming Gorge	88	3.24	3.67	6,029.41
Blue Mesa	74	0.61	0.83	7,494.56
Navajo	69	1.14	1.65	6,047.01
Lake Powell	37	8.75	23.31	3,573.02
UC System Storage	47	14.14	29.93	
Total System Storage	43	25.11	58.48	

Upper Colorado River Drainage Basin



### Month to Date Precipitation - October 16 2023

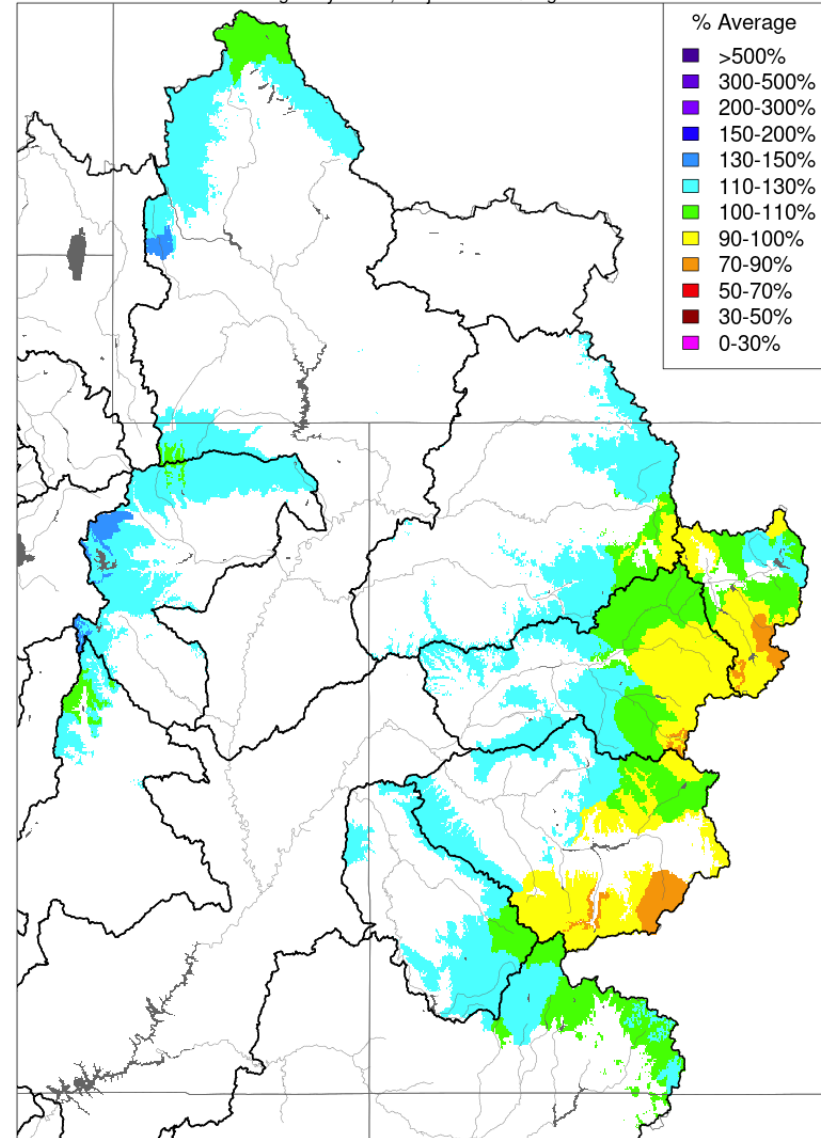
Averaged by Basin, Major Contributing Areas



Prepared by NOAA, Colorado Basin River Forecast Center  
Salt Lake City, Utah, [www.cbrfc.noaa.gov](http://www.cbrfc.noaa.gov)

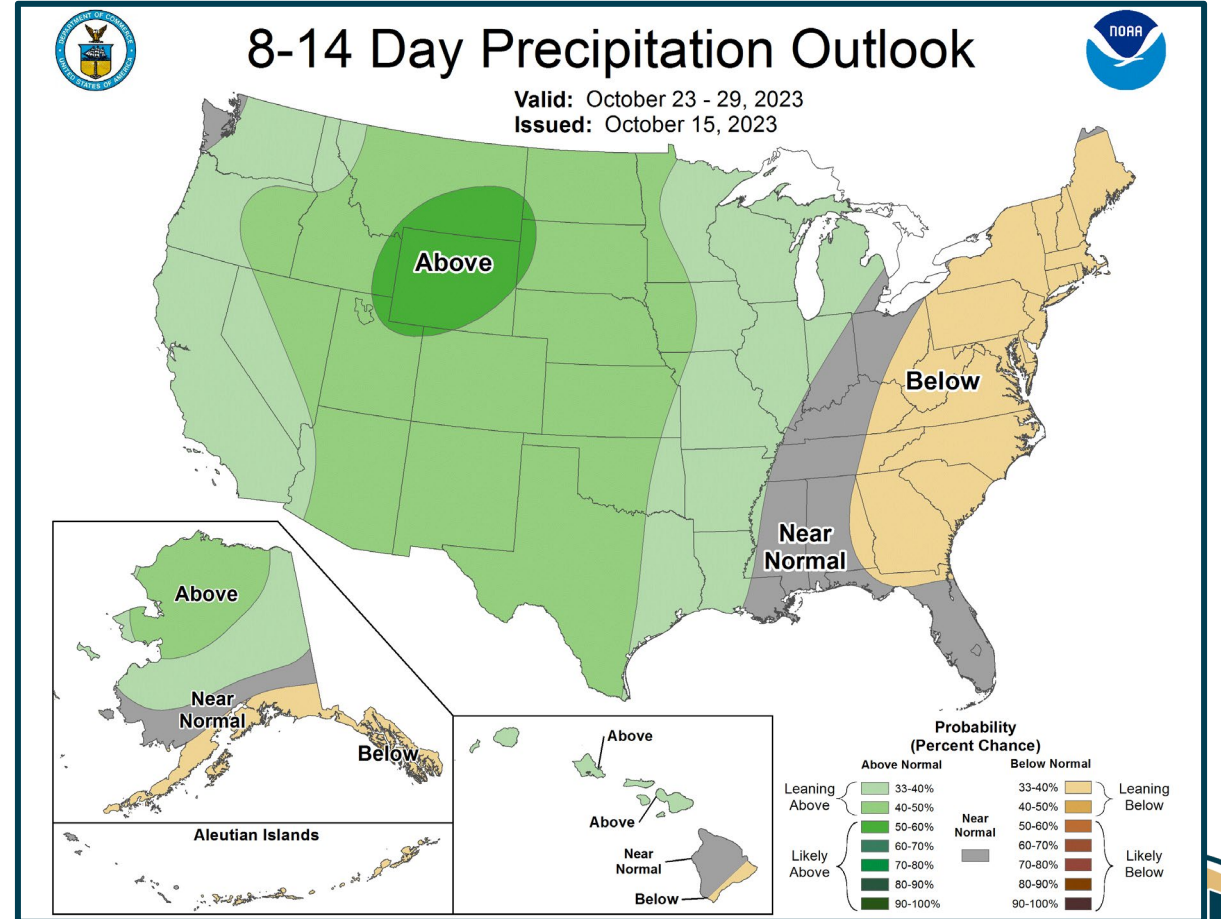
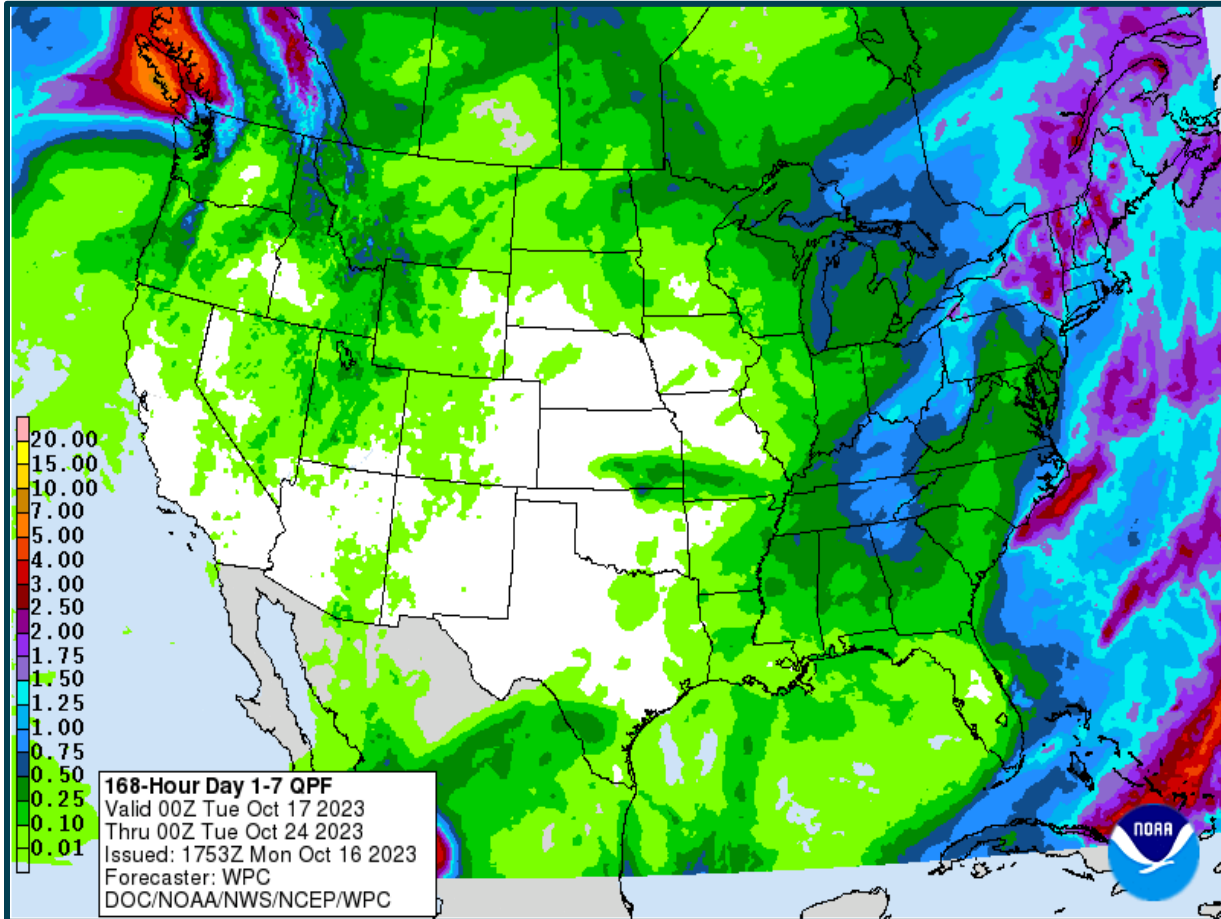
### Water Year Precipitation, October 2022 - September 2023

Averaged by Basin, Major Contributing Areas

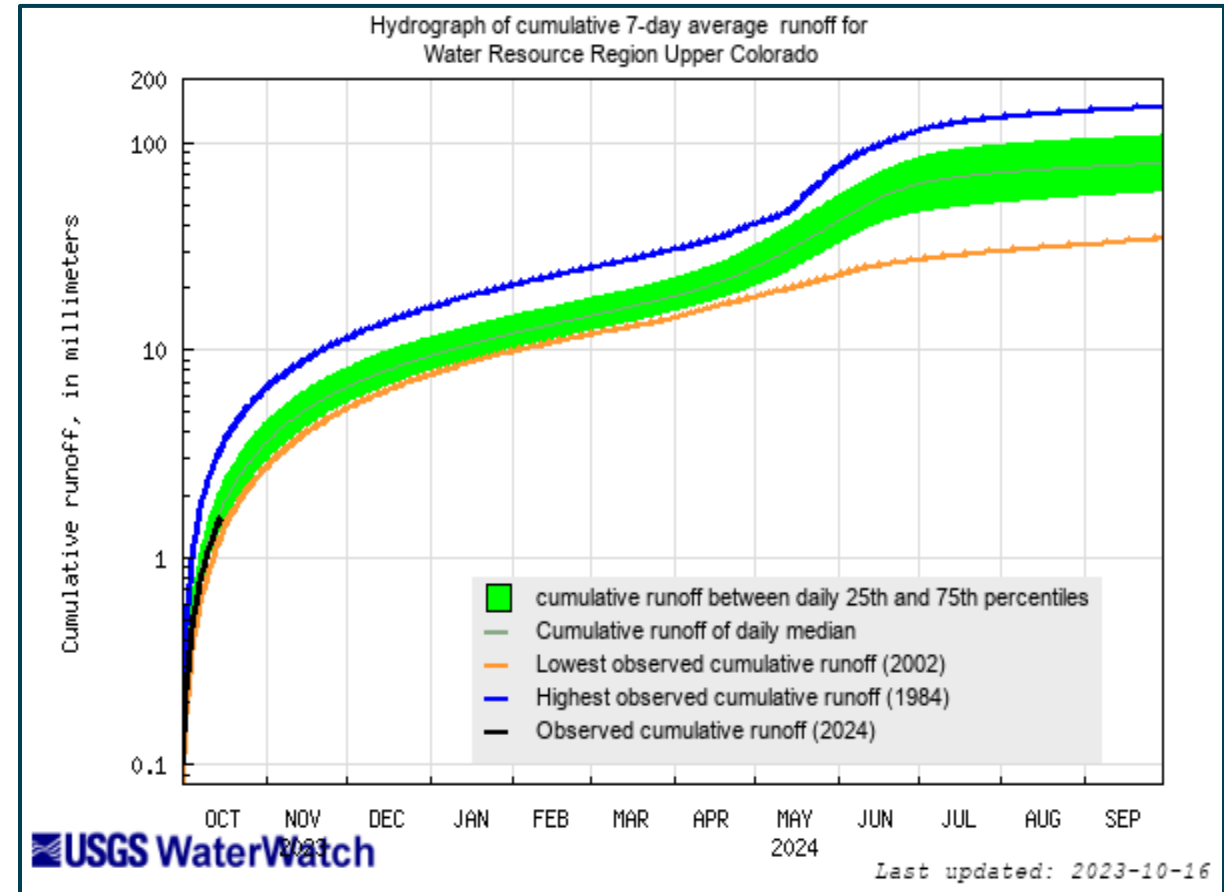
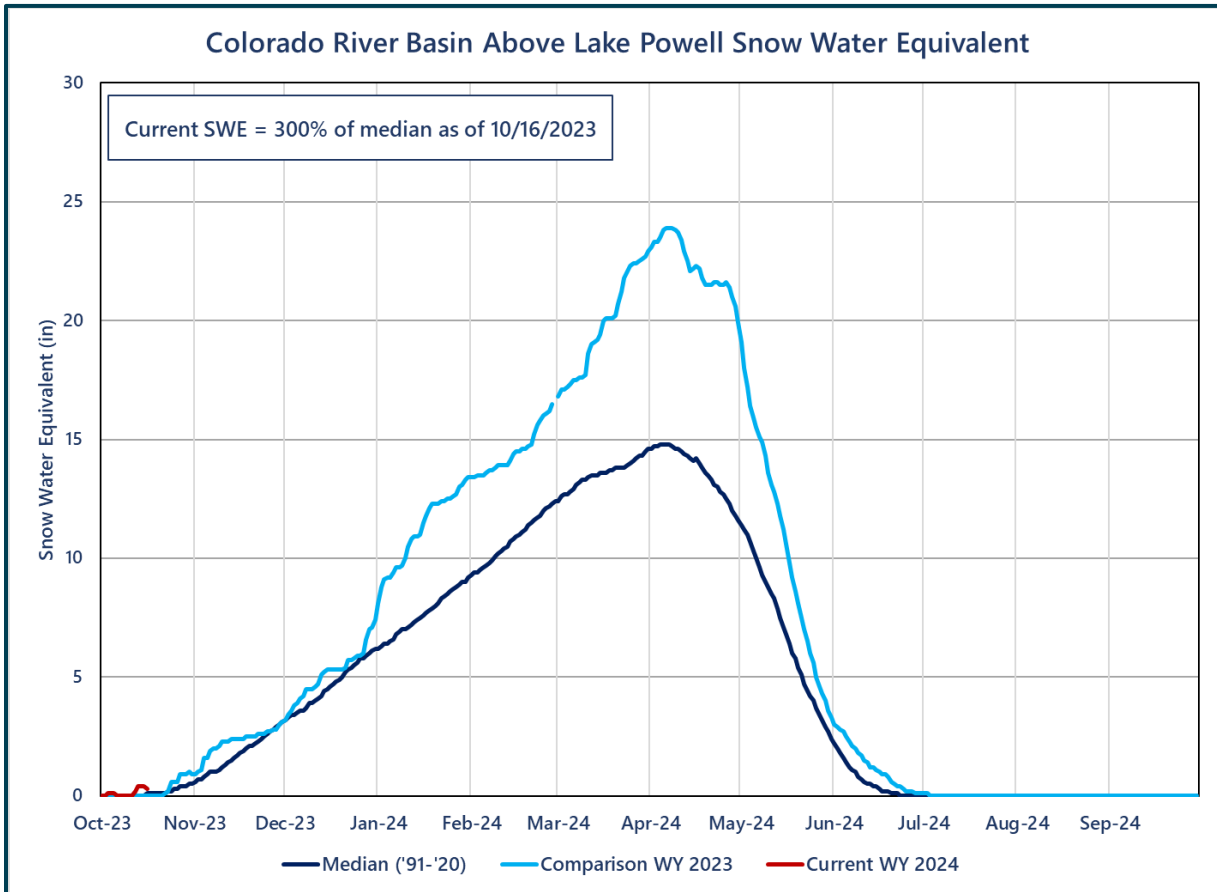


Prepared by NOAA, Colorado Basin River Forecast Center  
Salt Lake City, Utah, [www.cbrfc.noaa.gov](http://www.cbrfc.noaa.gov)

# Weather Prediction Center and Climate Prediction Center Precipitation Forecasts



# Upper Colorado SWE and Observed Inflows



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



# Preliminary Observed Water Year 2023

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

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

<sup>1</sup>Averages are based on the 1991 through 2020 period of record.



# Most Probable October Forecast Water Year 2024

April – July 2024  
Forecasted Unregulated Inflow  
as of October 2, 2023

Reservoir	Inflow (kaf)	Percent of Avg <sup>1</sup>
Fontenelle	685	93
Flaming Gorge	925	96
Blue Mesa	595	94
Navajo	539	86
Powell	6,235	101

Water Year 2024  
Unregulated Inflow Forecast  
as of October 2, 2023

Reservoir	Inflow (kaf)	Percent of Avg <sup>1</sup>
Fontenelle	1,025	95
Flaming Gorge	1,390	99
Blue Mesa	845	93
Navajo	760	83
Powell	9,400	98

<sup>1</sup>Averages are based on the 1991 through 2020 period of record.

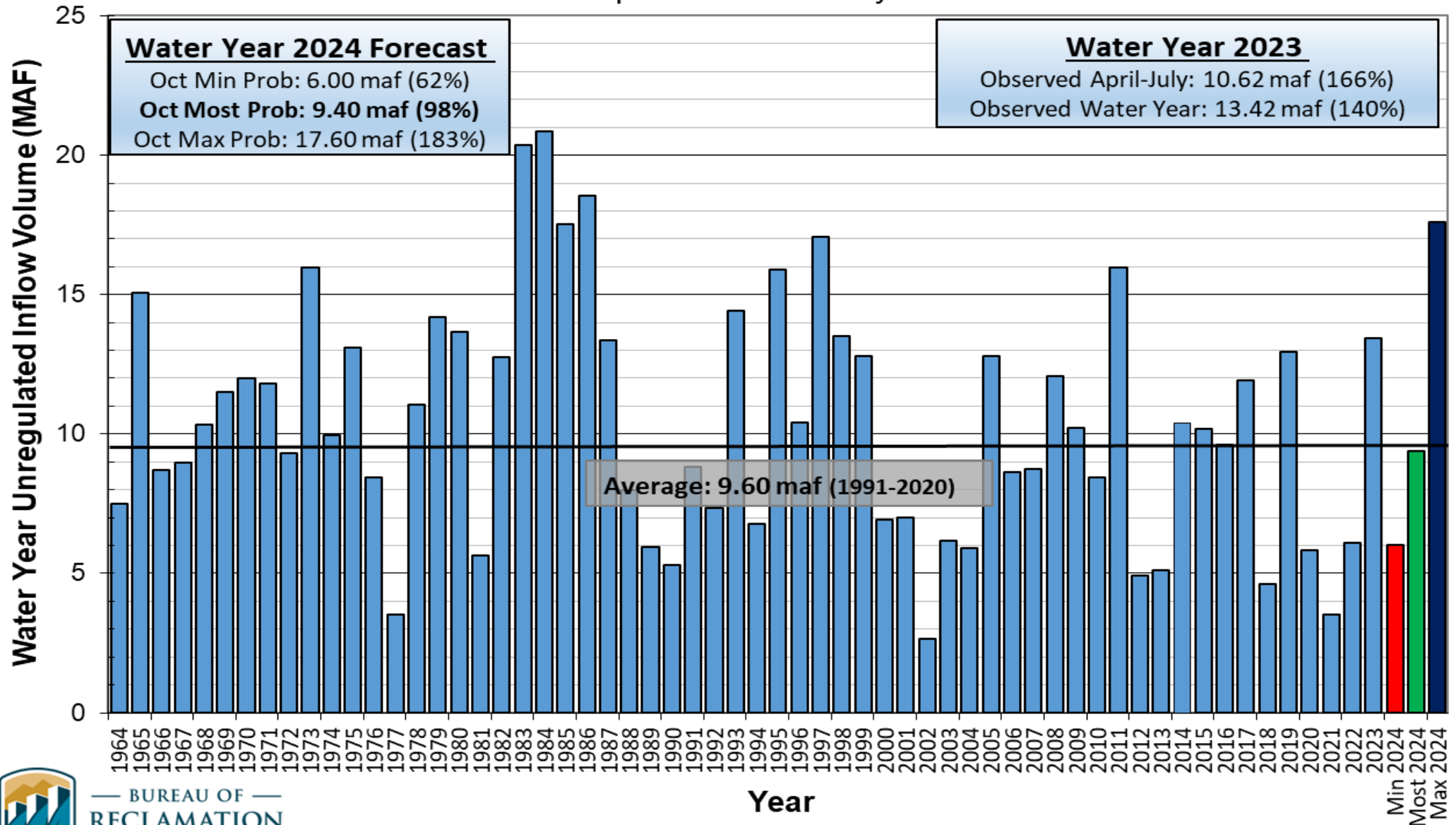




# Lake Powell Unregulated Inflow

## Water Year 2024 Forecast (issued October 2)

### Comparison with History



BUREAU OF RECLAMATION

Year





# Upper Colorado Basin

Hydrology and Operations  
Projections Based on August  
and September 2023 24-  
Month Study



# Upper Basin Reservoir Operations

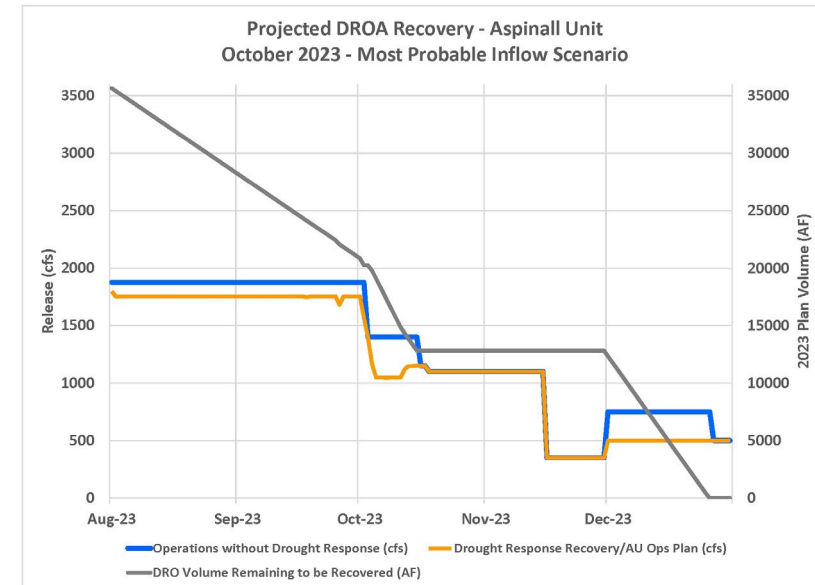
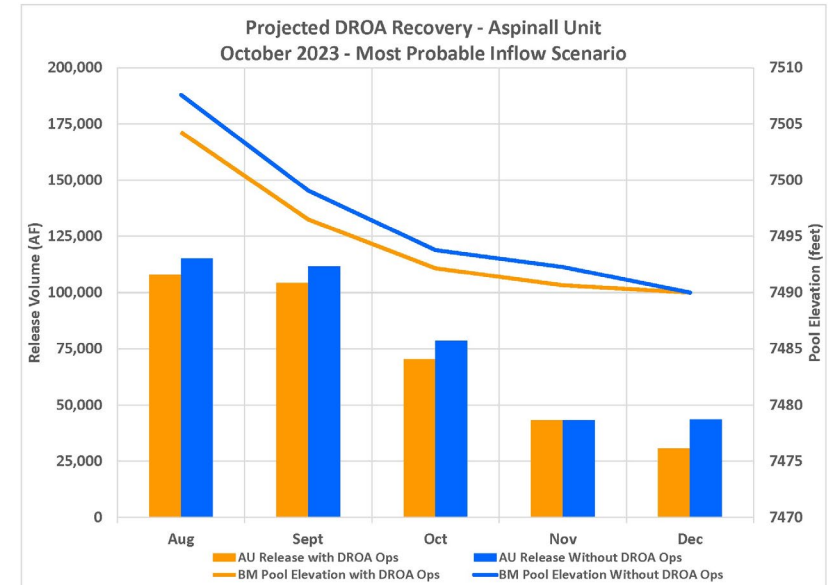
## Water Years 2023 and 2024

- 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.



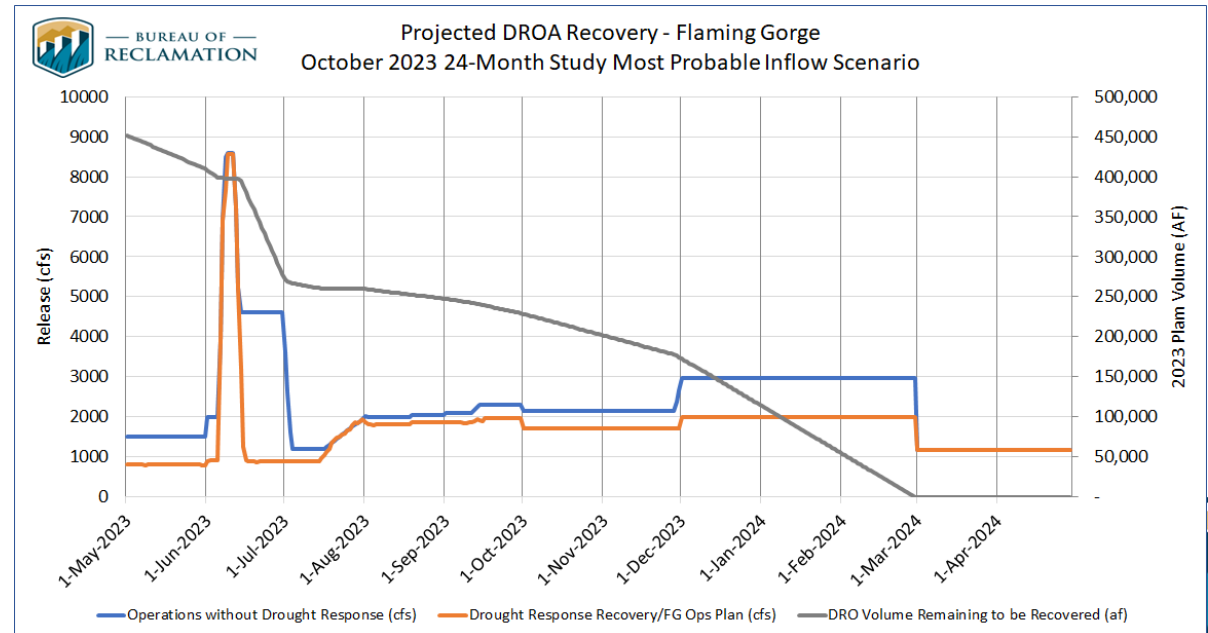
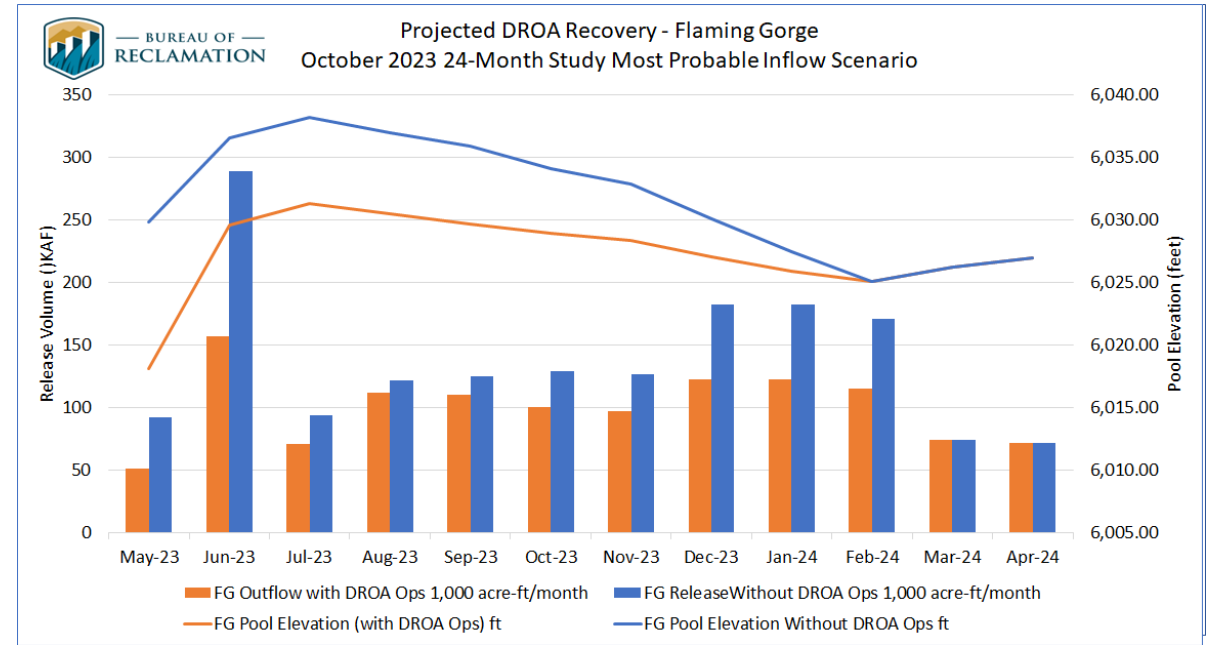
# DROA Recovery - BM

- August 2023 – approx. 7.4 kaf
- September 2023 - approx. 7.3 kaf
- Projected to achieve incremental recovery and icing target by the end of Dec 23



# DROA Recovery - FG

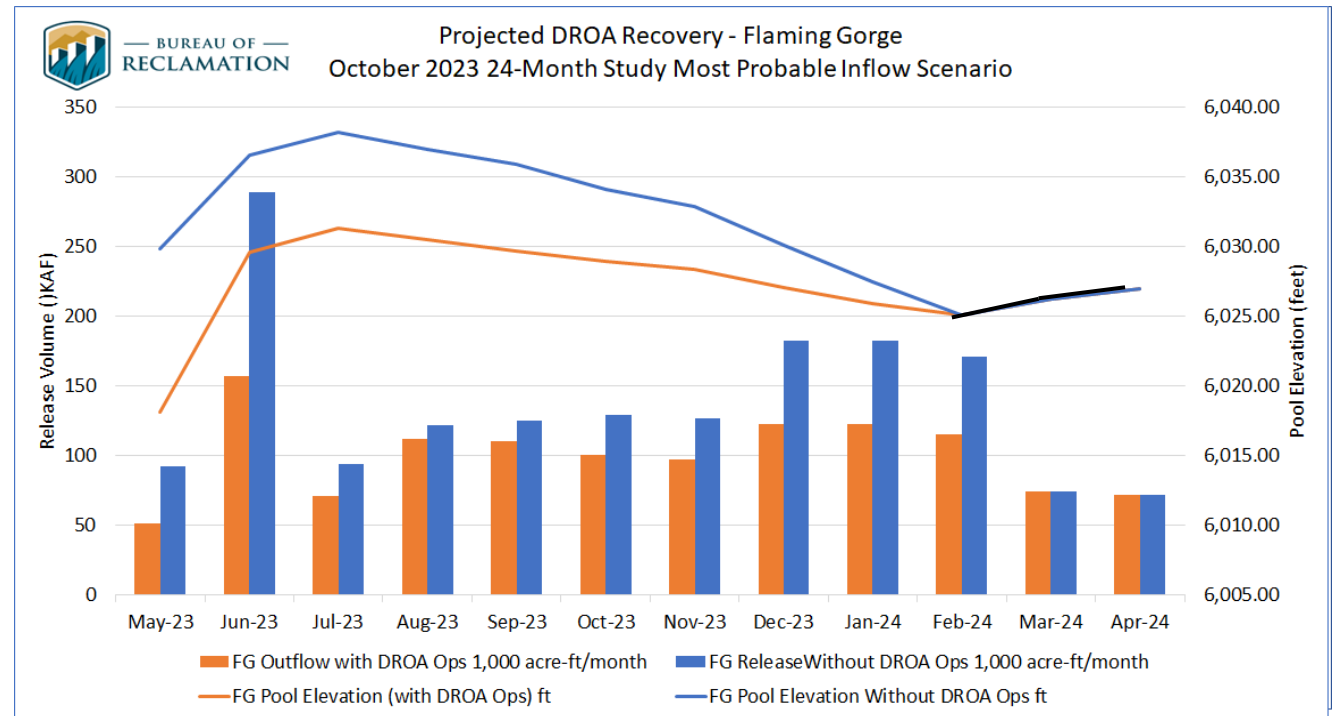
- August 2023 - approx. 12 kaf
- September 2023 - approx. 19 kaf
- Projected to achieve incremental recovery in February 2024 and the May 1 Drawdown Target of 6,027



# Drought Response Operations Agreement (DROA)

## Completed DROA Volumes<sup>1,2</sup>

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



<sup>1</sup>DROA operational year is from May through April.

<sup>2</sup>Positive values indicate Drought Response Operations Releases and negative values indicate Drought Response Operations Recovery

<sup>3</sup> 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

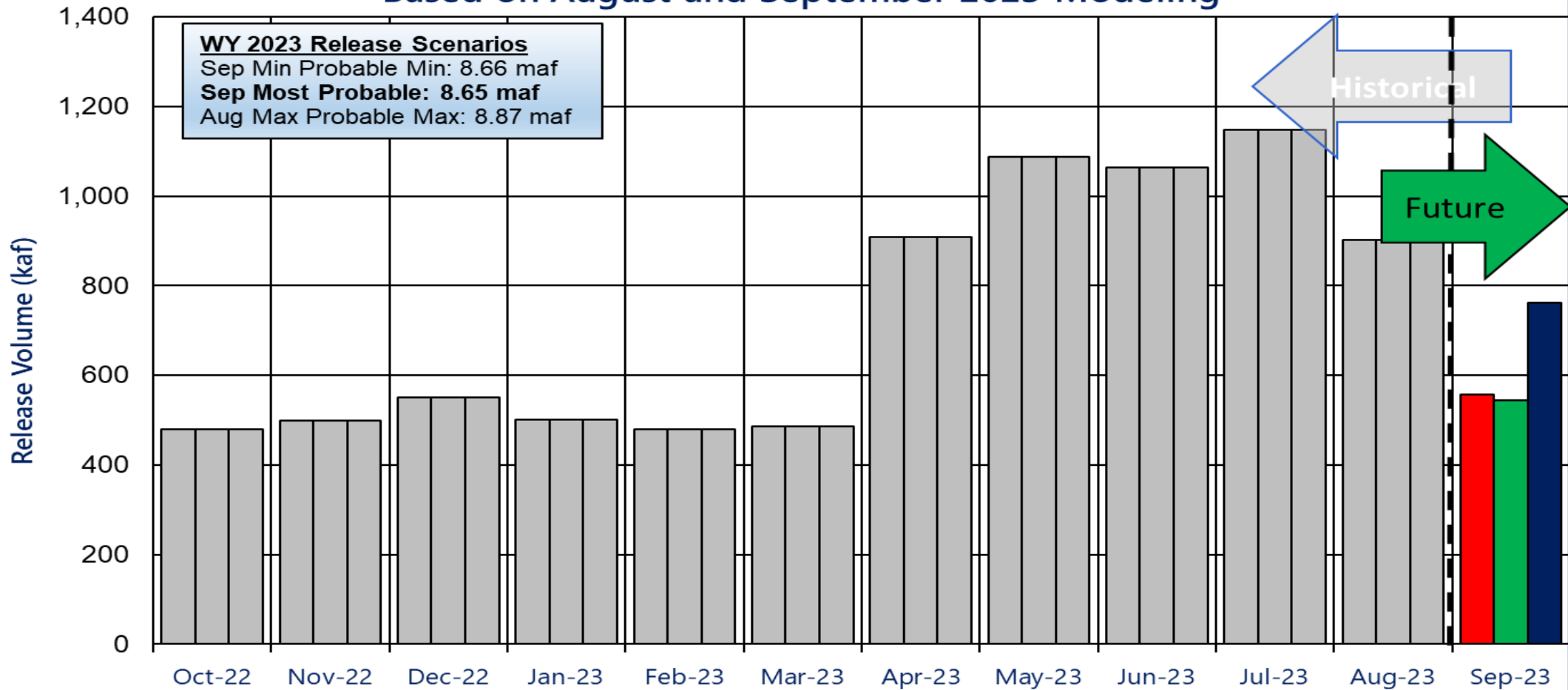
<sup>4</sup>DROA volumes through September 2023



# Potential Lake Powell Monthly Release Volume Distribution

## Release Scenarios for Water Year 2023

### Based on August and September 2023 Modeling

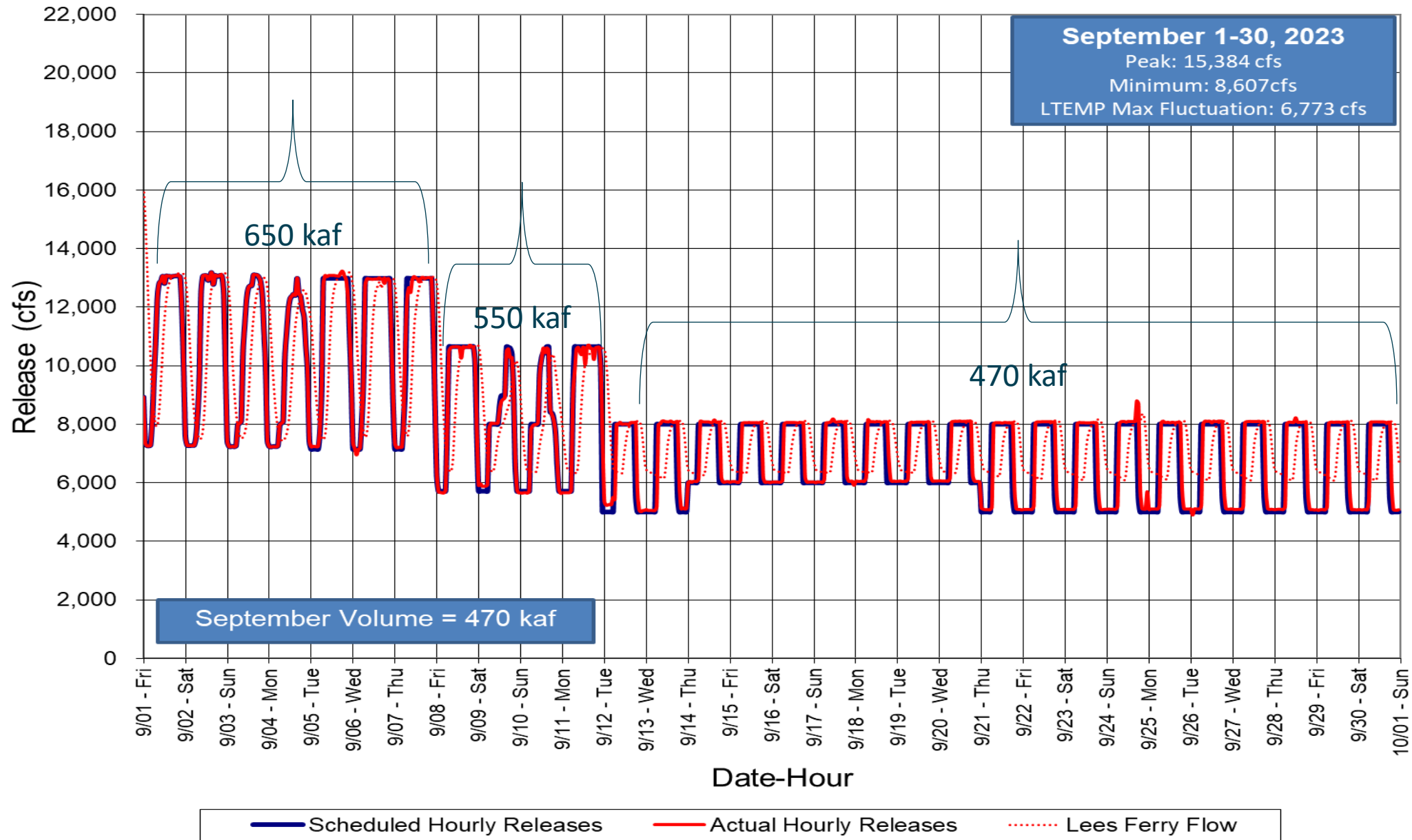


	10/1/2022	11/1/2022	12/1/2022	1/1/2023	2/1/2023	3/1/2023	4/1/2023	5/1/2023	6/1/2023	7/1/2023	8/1/2023	9/1/2023
■ Sept Min Probable	480.052	498.343	549.767	500.681	480.408	486.044	909.310	1,088.254	1,063.574	1,149.012	901.664	556.675
■ Sept Most Probable	480.052	498.343	549.767	500.681	480.408	486.044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

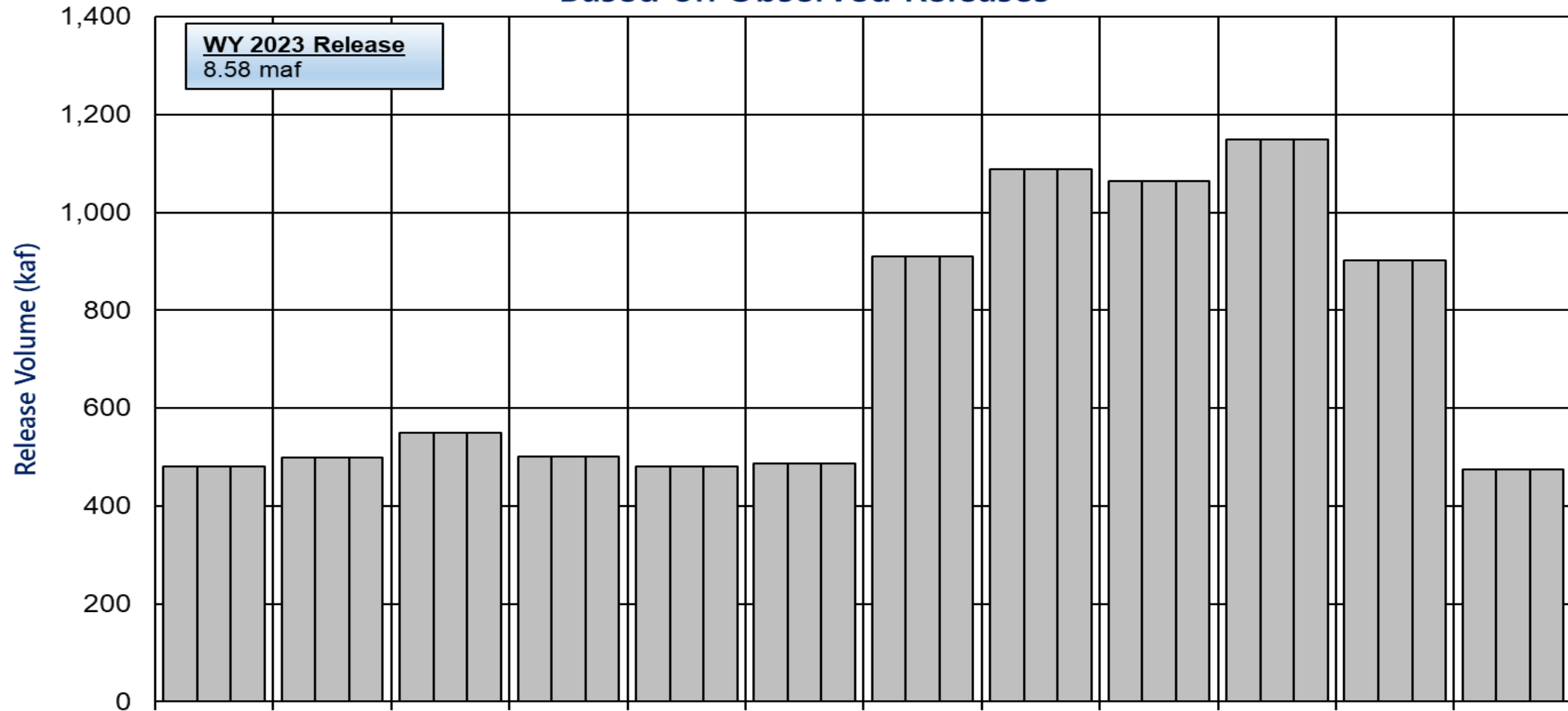




# Potential Lake Powell Monthly Release Volume Distribution

## 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

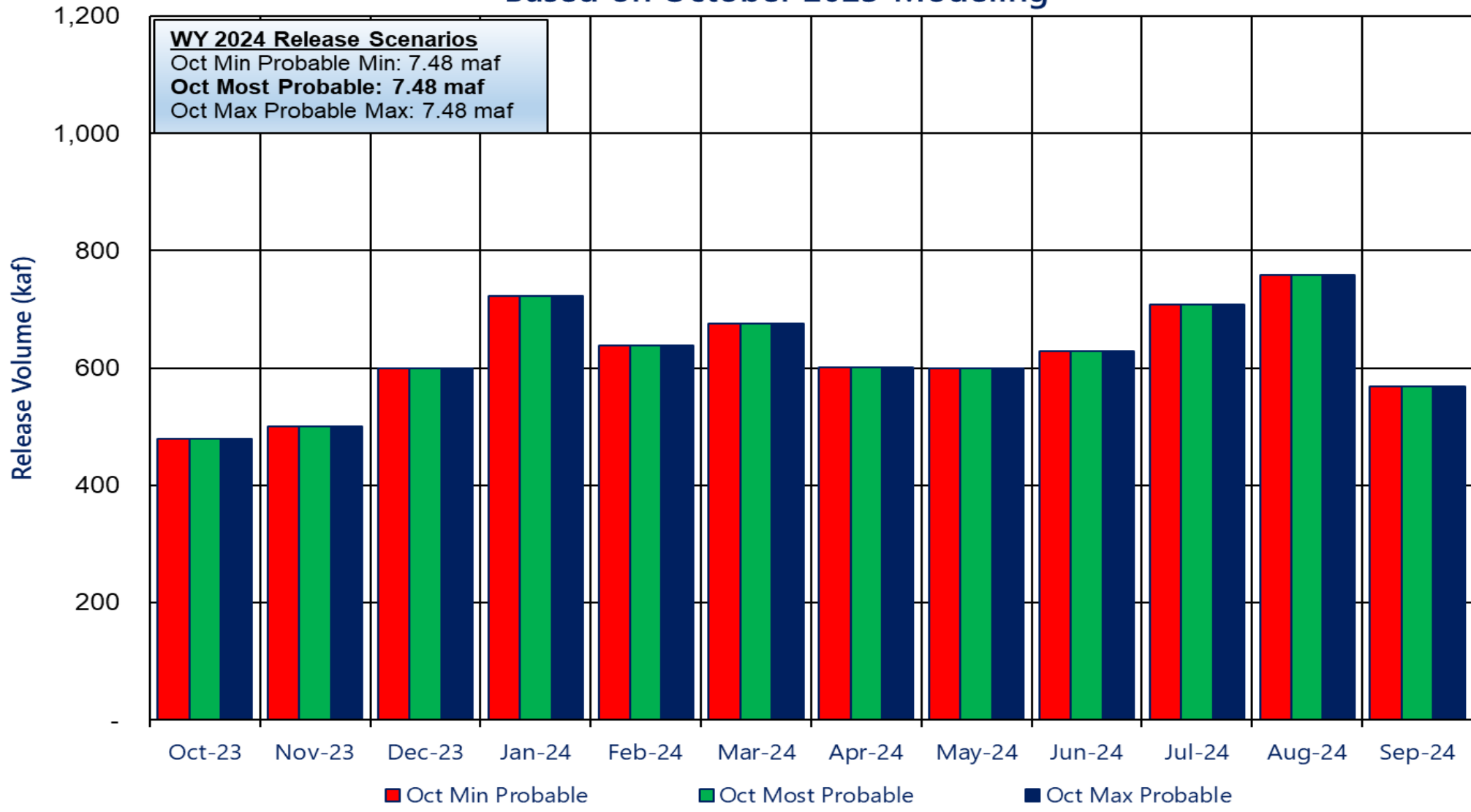
■ Oct Min Probable      ■ Oct Most Probable      ■ Oct Max Probable



# Potential Lake Powell Monthly Release Volume Distribution

## Release Scenarios for Water Year 2024

### Based on October 2023 Modeling

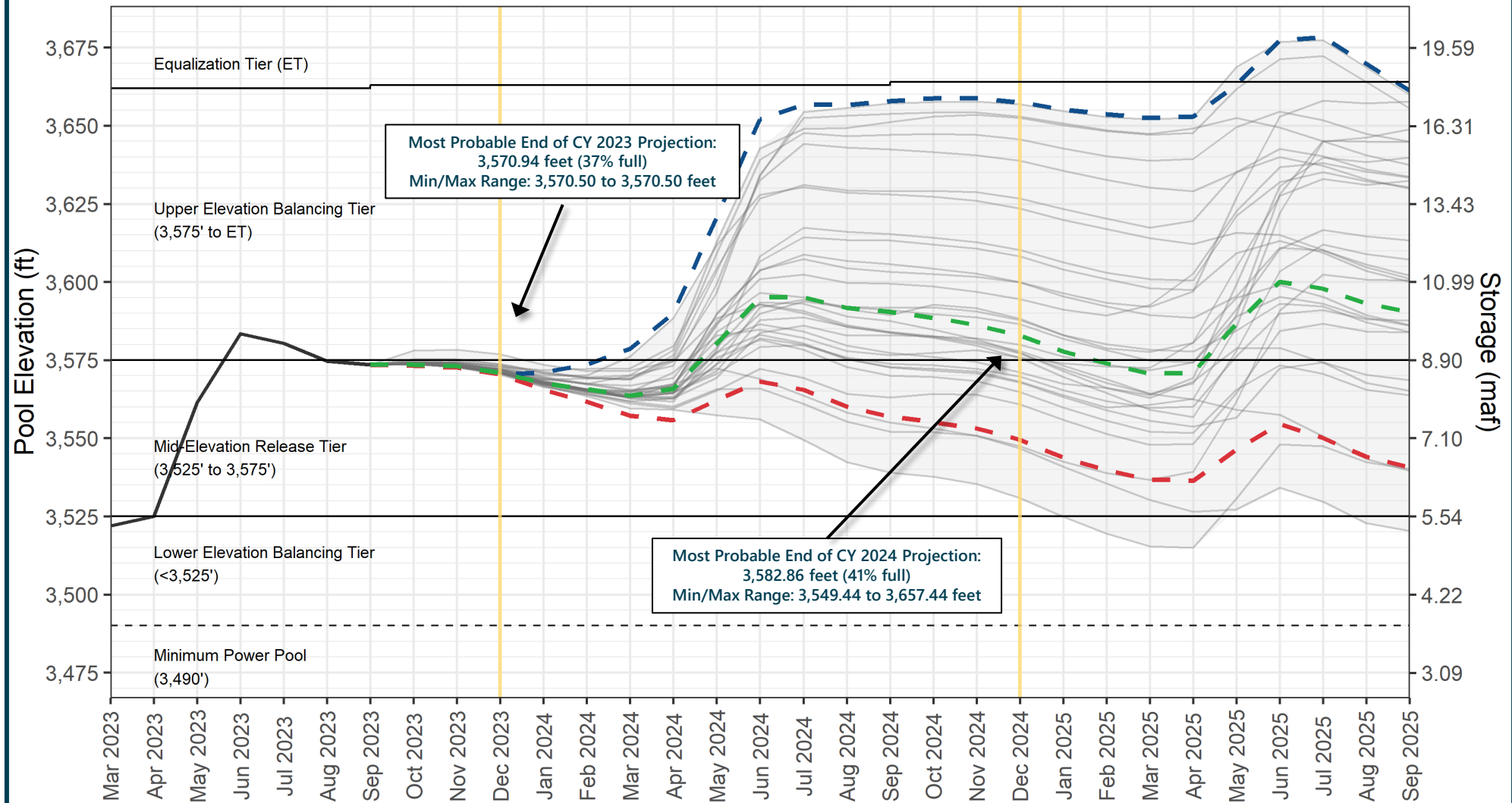


# Reclamation Operational Modeling Model Comparison

	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



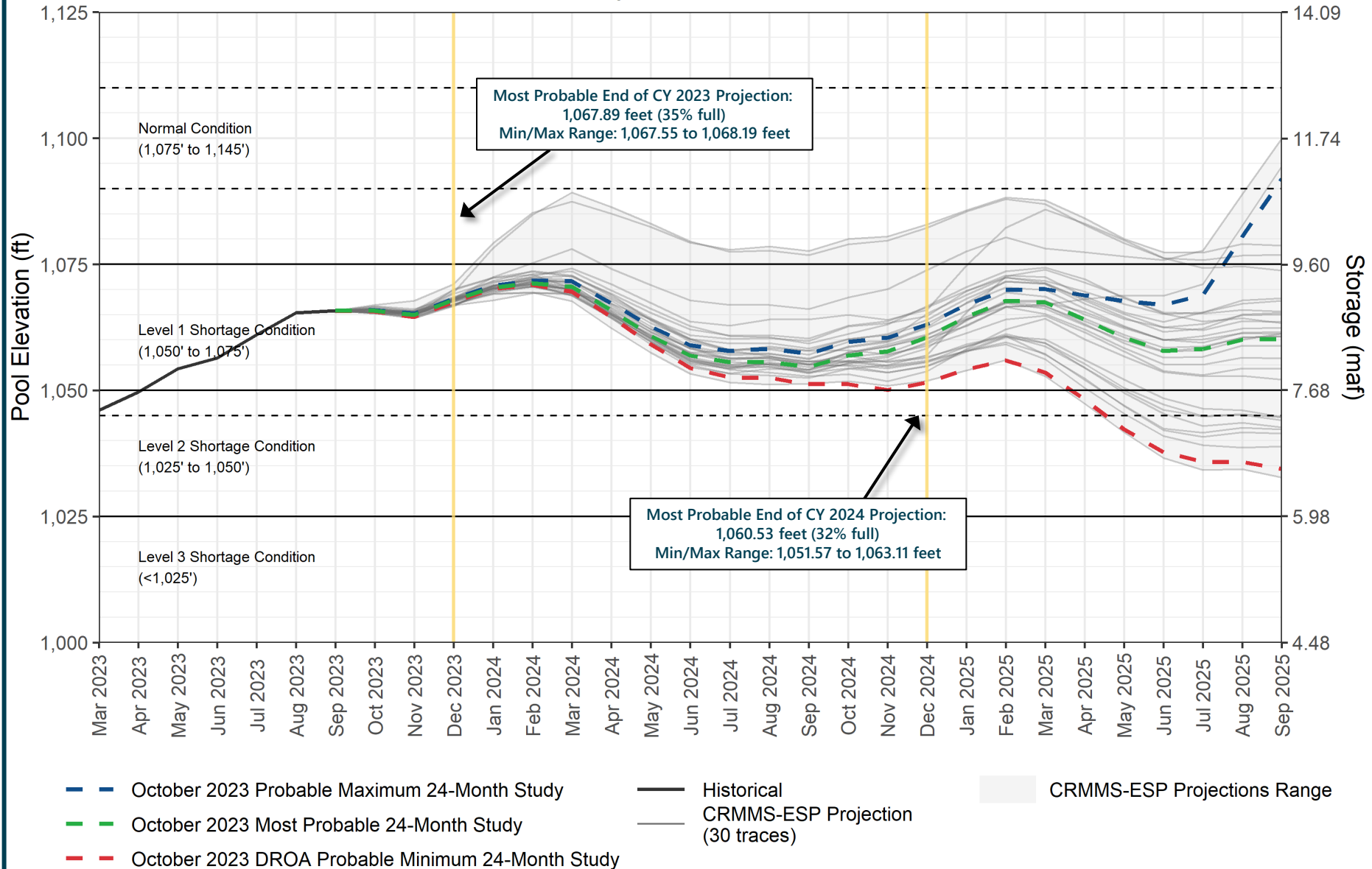
# Lake Powell End-of-Month Elevations CRMMS Projections from October 2023



- 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) <sup>1</sup>	480	500	600	723	639	675	601	599	628	709	758	568
Most (kaf) <sup>1</sup>	480	500	600	723	639	675	601	599	628	709	758	568
Min (kaf) <sup>1</sup>	480	500	600	723	639	675	601	599	628	709	758	568

OCT MOST<sup>2</sup>

OCT MOST

7.48 maf

7.48 maf

7.48 maf

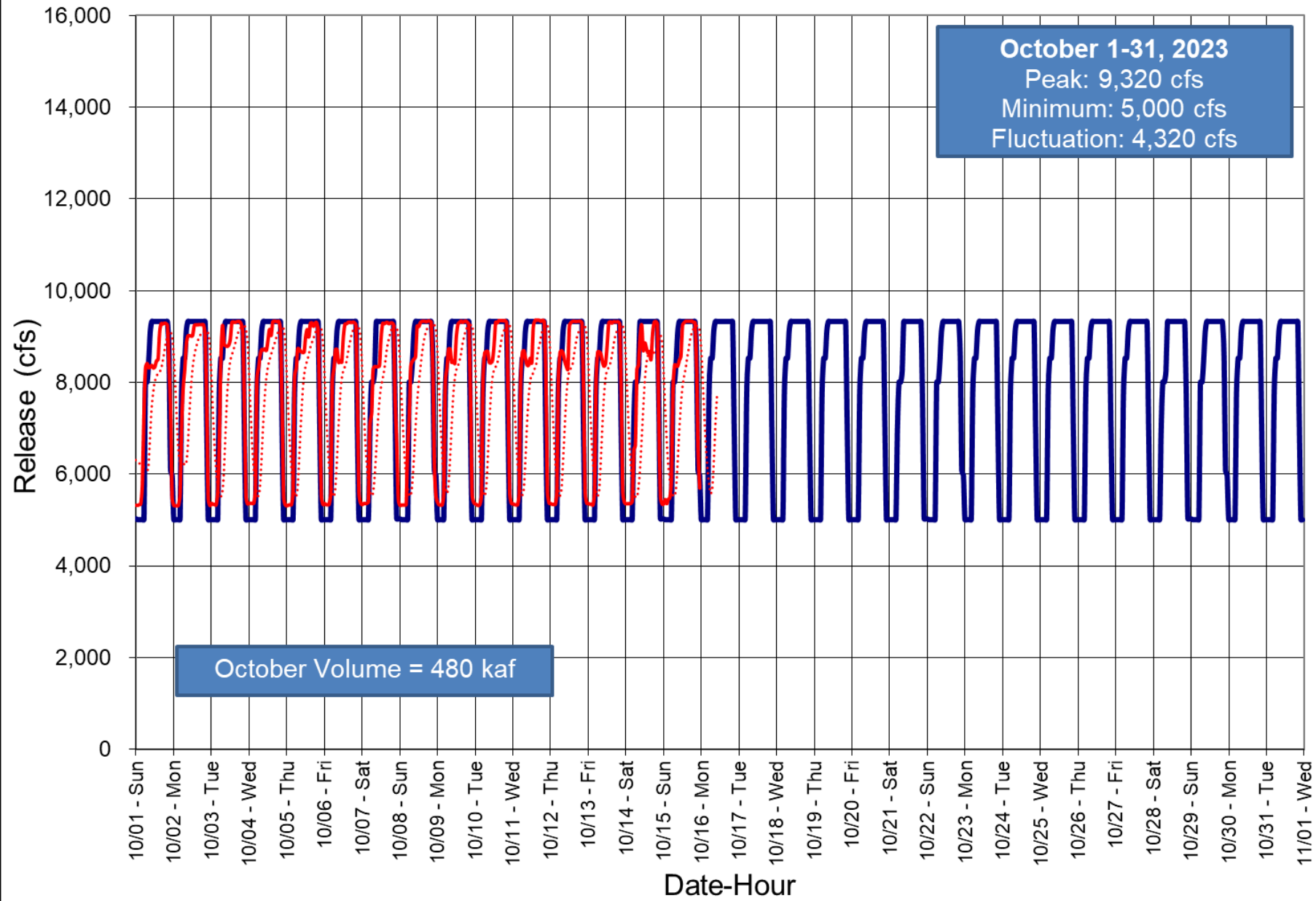
(updated 10-17-2023)

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.

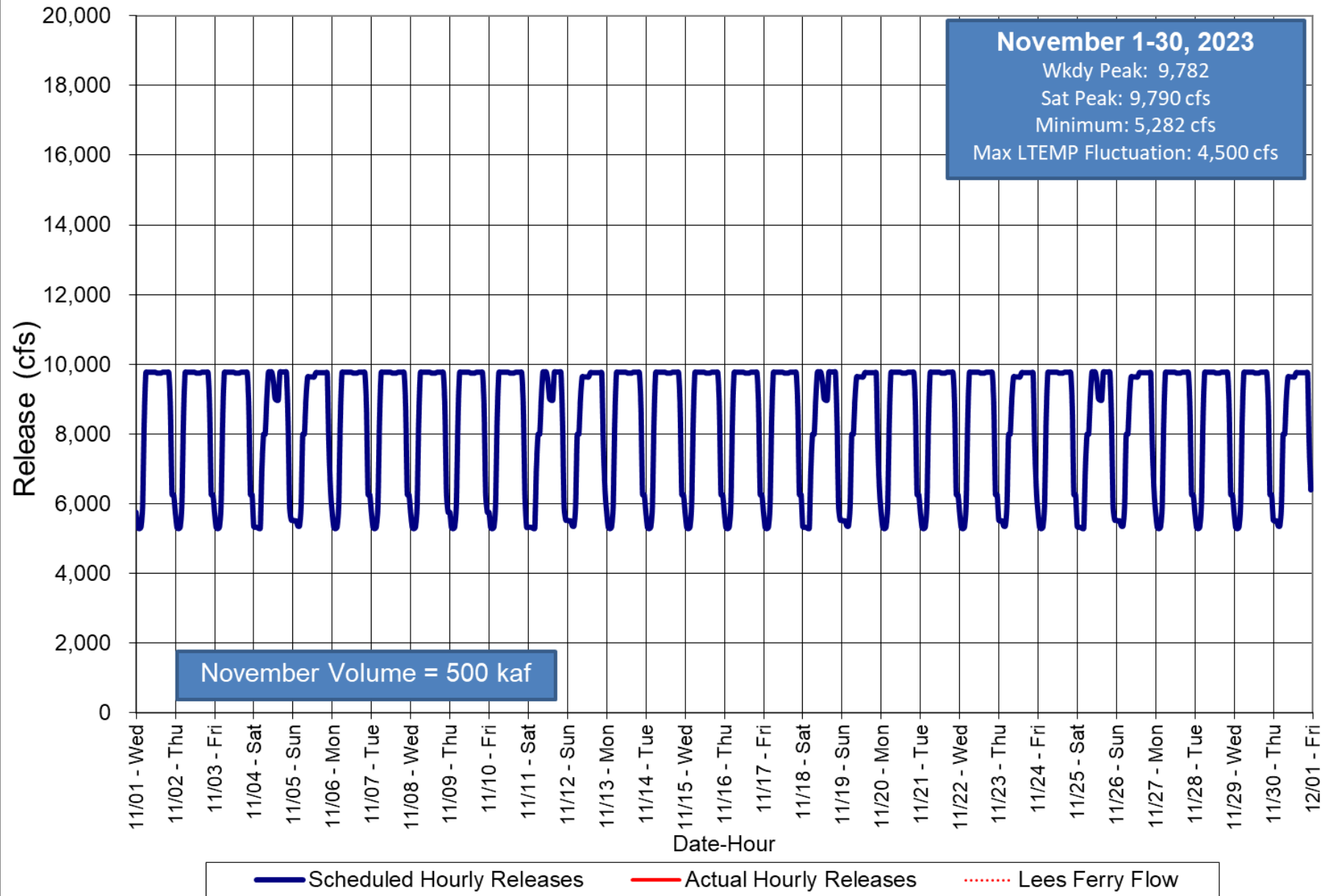


# Glen Canyon Dam Hourly Release Pattern October 2023

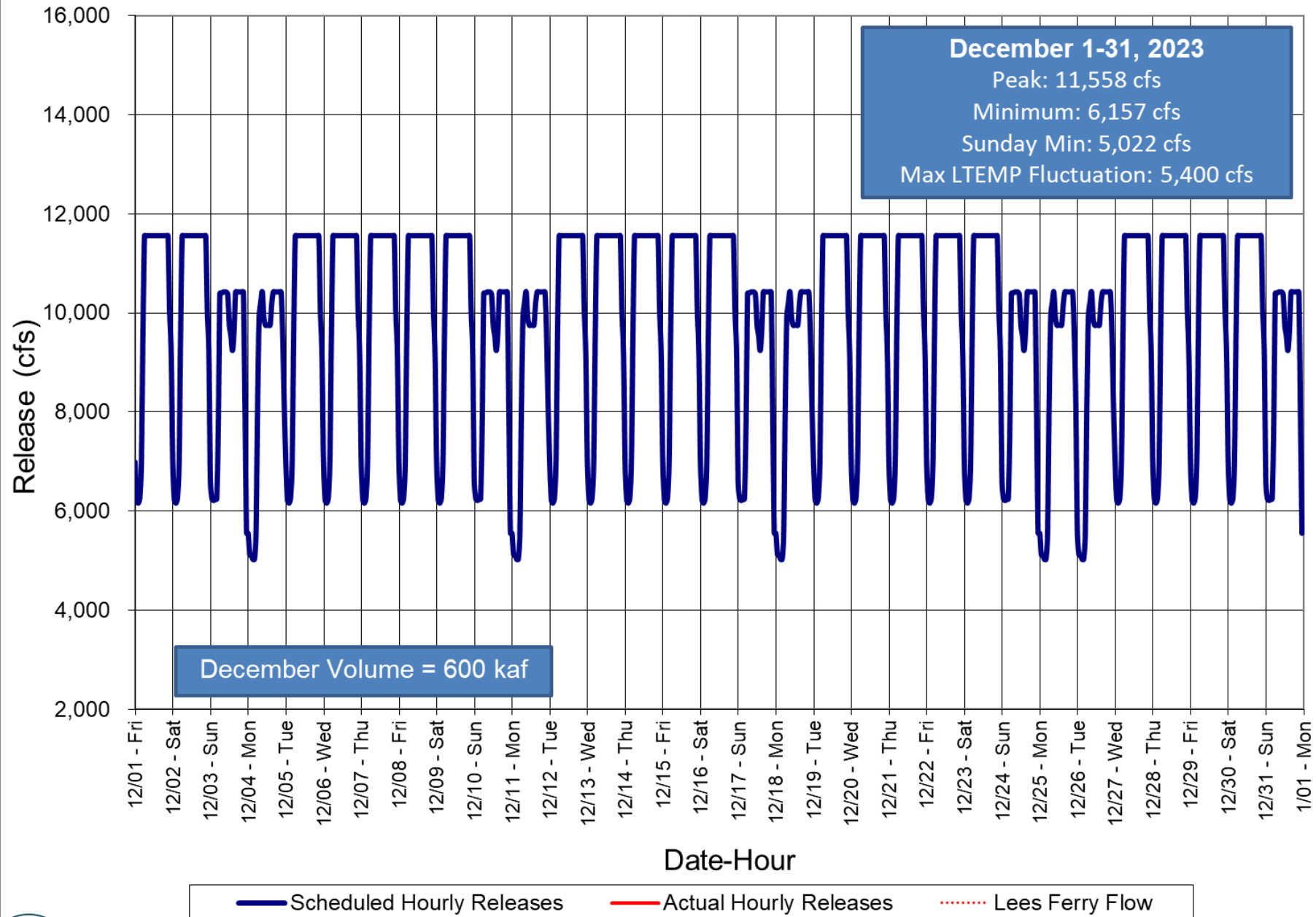




# Glen Canyon Dam Hourly Release Pattern November 2023



# Glen Canyon Dam Hourly Release Pattern December 2023

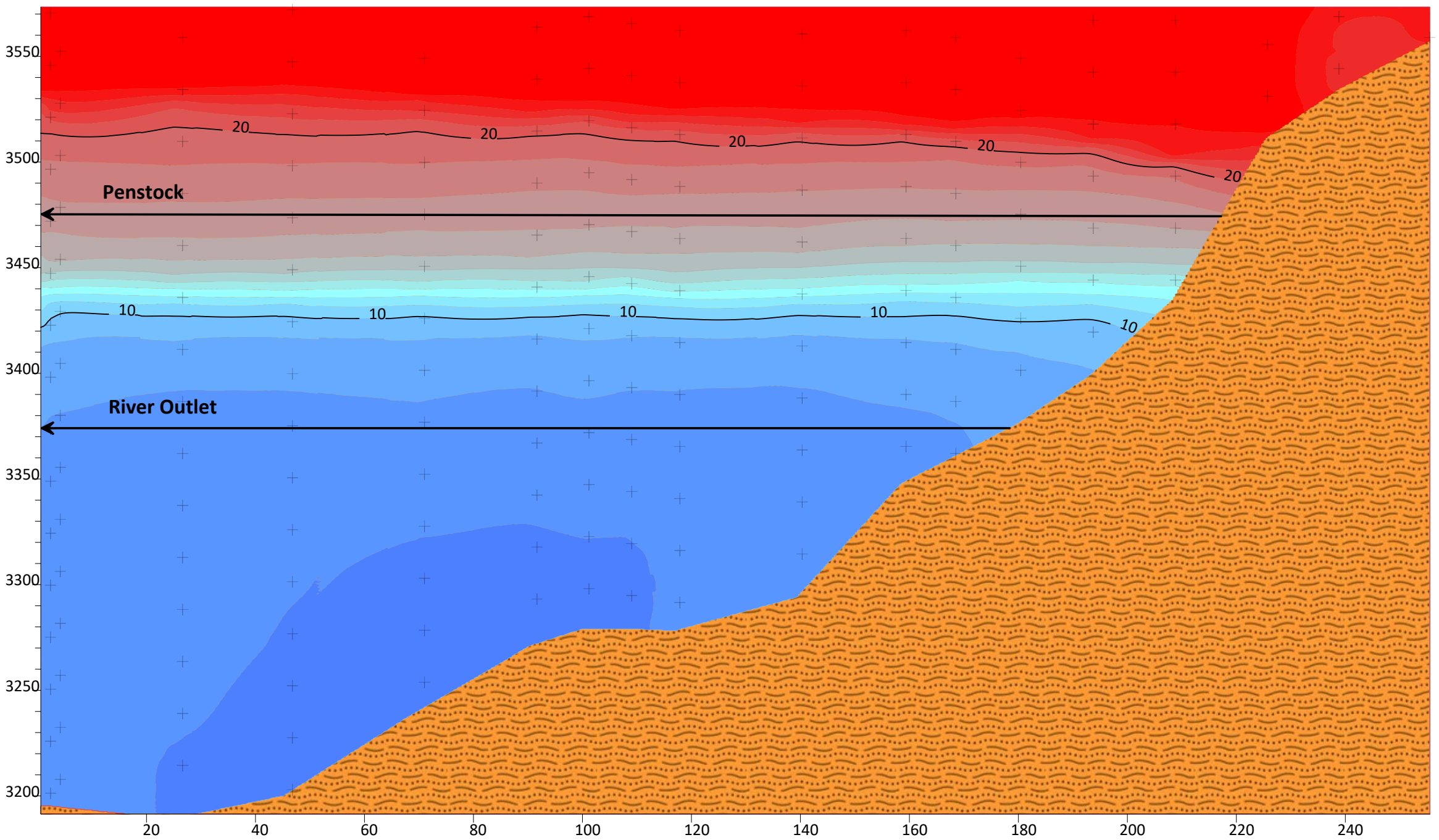


# Water Quality

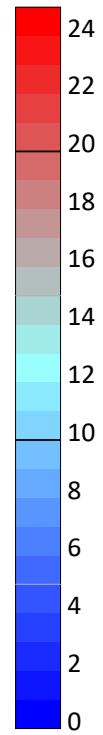


# Lake Powell Temperature Sept 2023

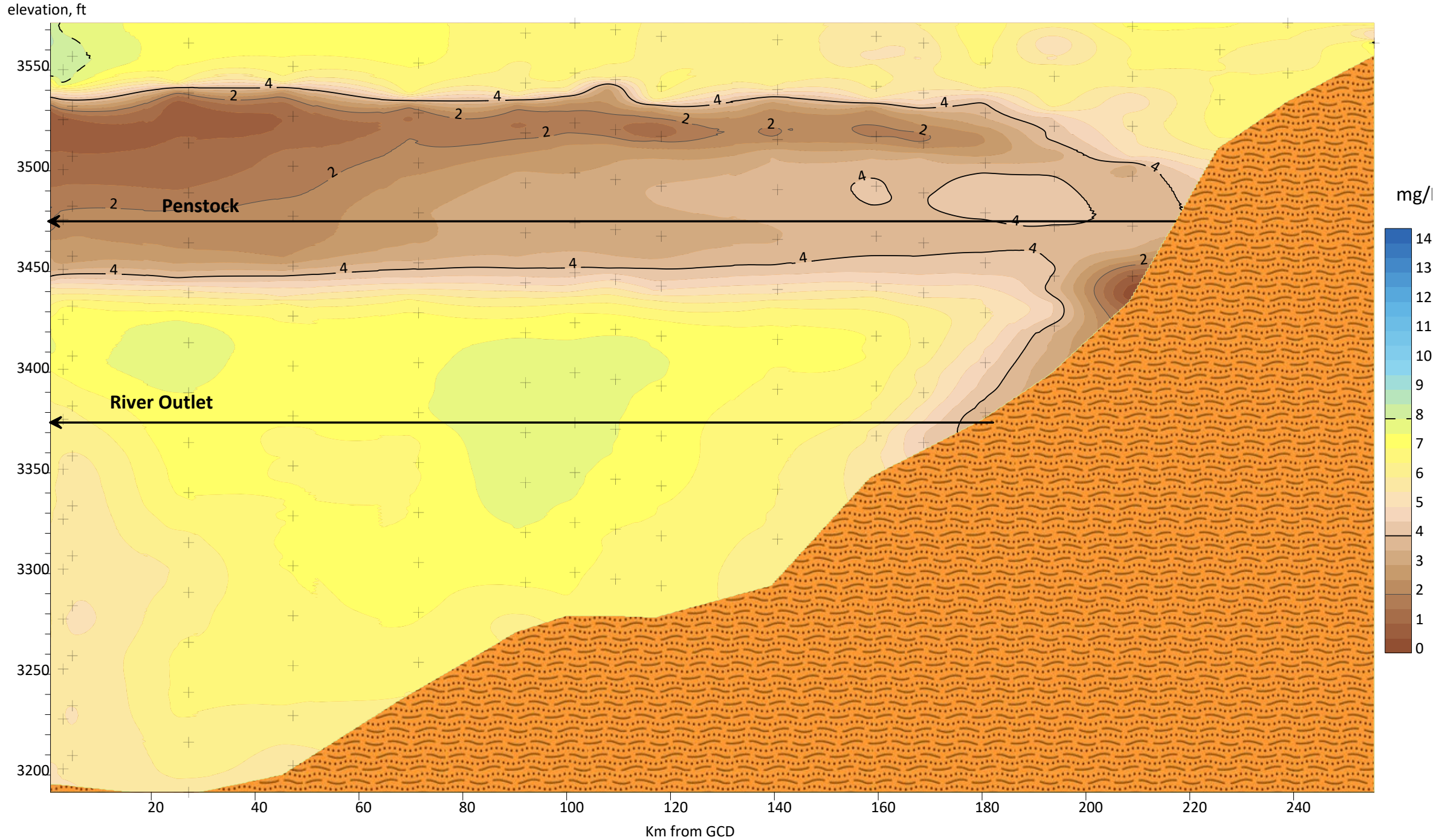
elevation, ft



Deg C



# Lake Powell Dissolved Oxygen, Sept 2023

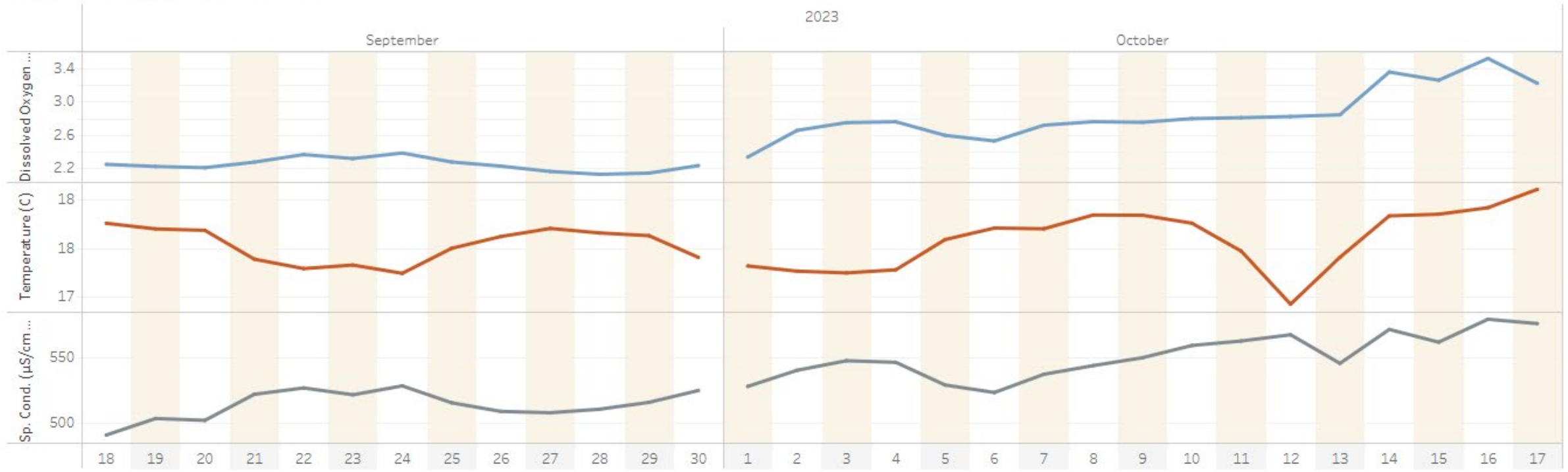


# Daily Water Quality Data at Glen Canyon Dam

[Download PDF](#)



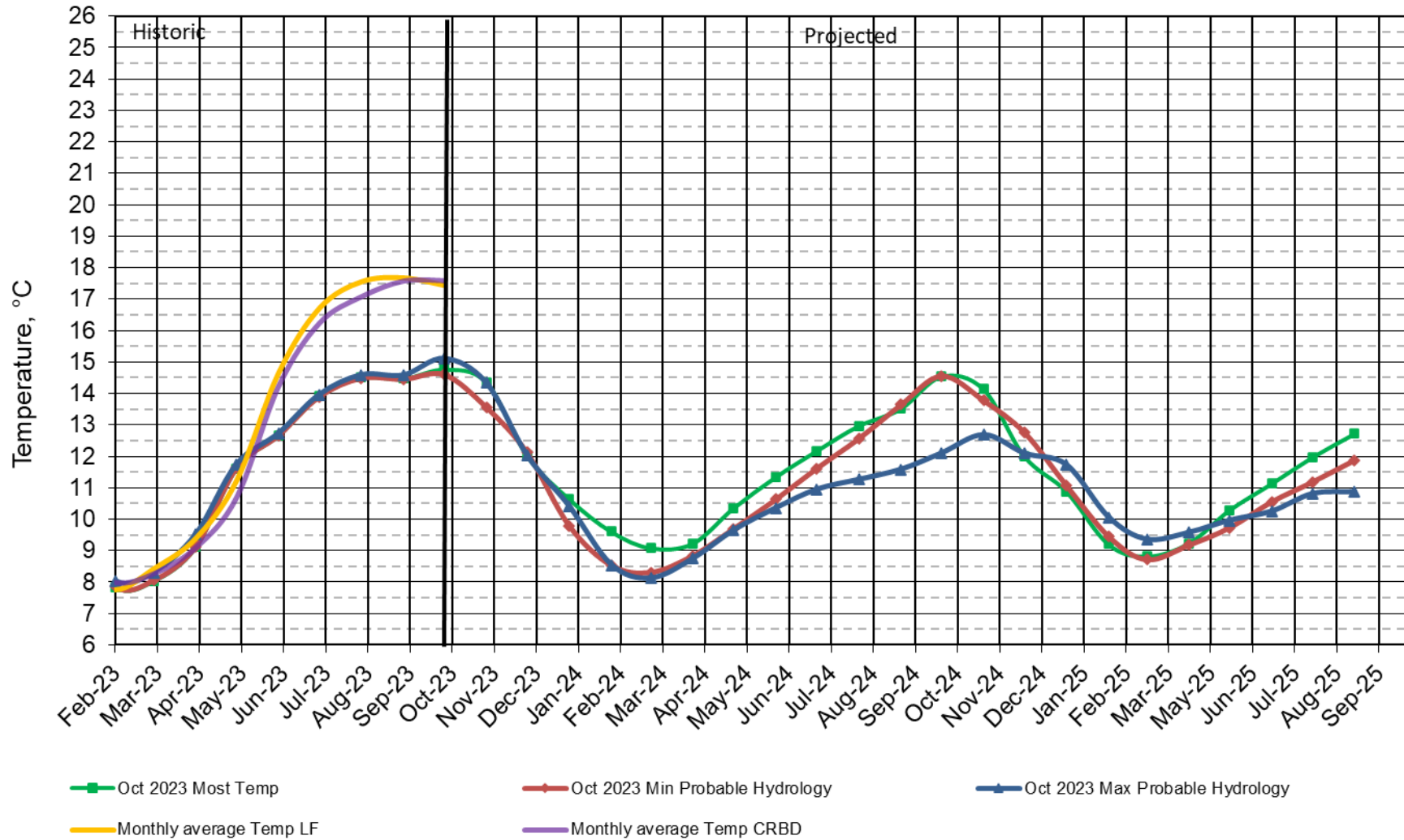
Daily Dissolved Oxygen & Temperature Values



The trends of daily average Dissolved Oxygen, Temperature and Specific Conductance shown for the past 30 days.

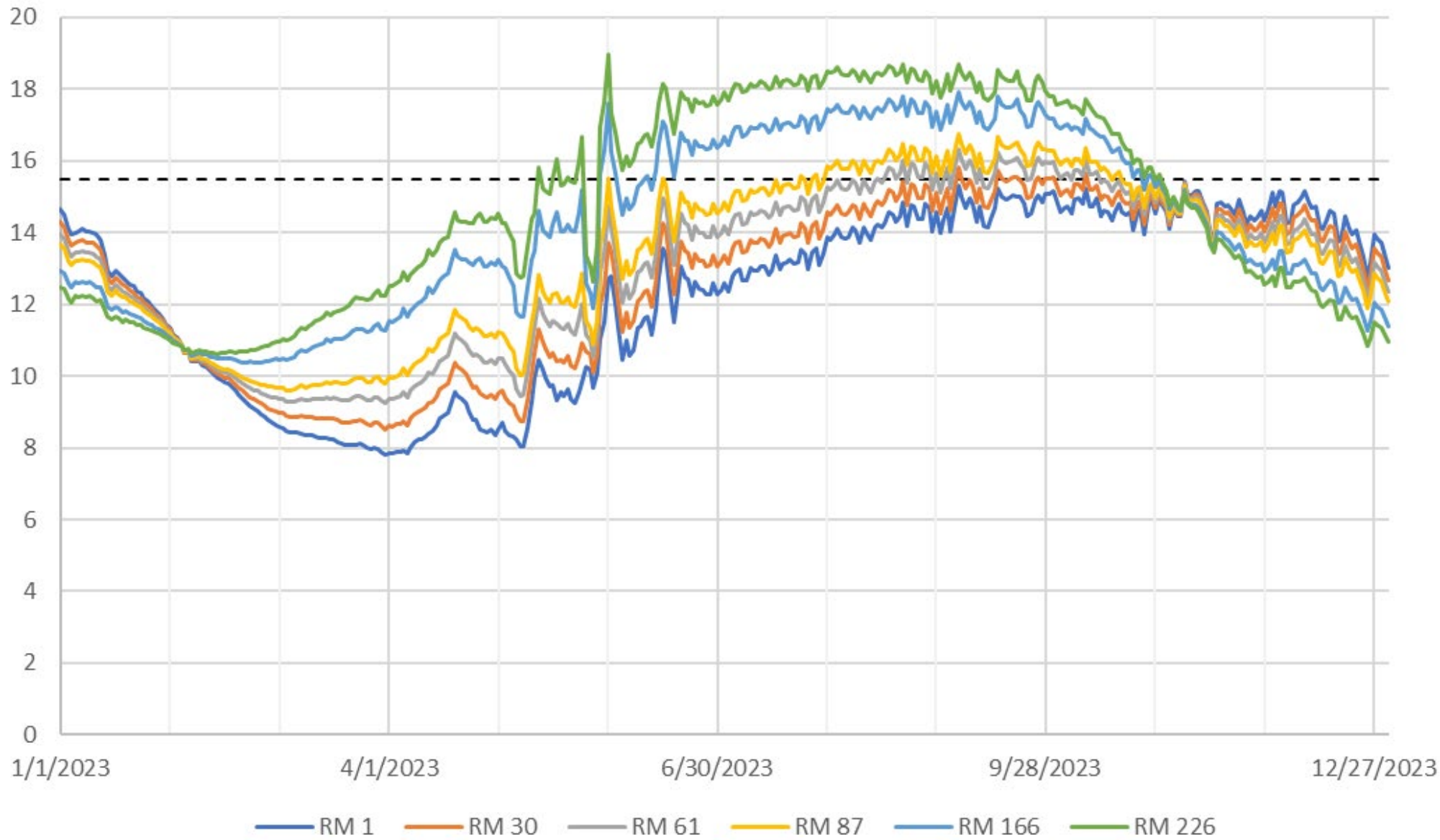
## Lake Powell Release Temperature

Projected Temperature based on October 2023 Forecast



#Projection start date is based on initial conditions (March 2021)

# Oct 2023 Most Dibble et al. Grand Canyon Temperature Projections





# Questions?



— BUREAU OF —  
RECLAMATION