



— BUREAU OF —
RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

April 26, 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.”

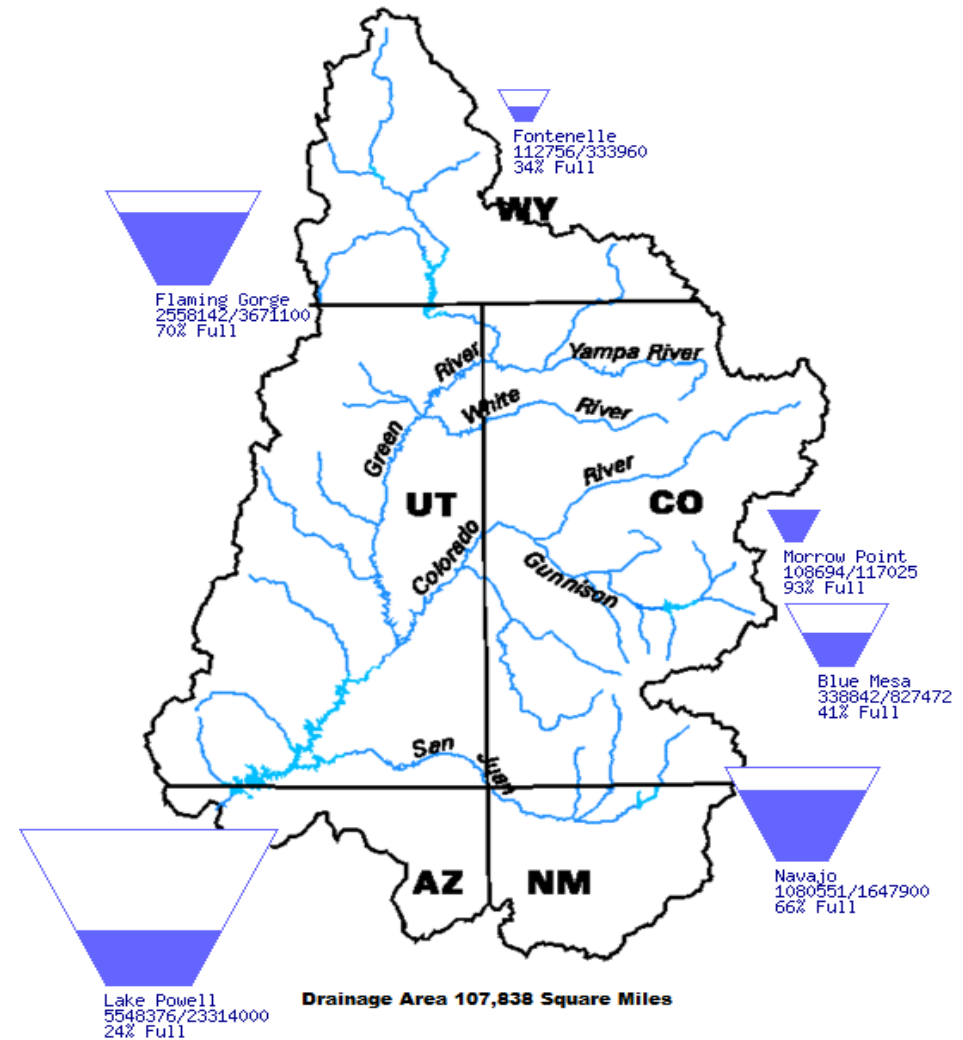


Upper Basin Storage (as of April 24, 2023)

Data Current as of:
04/24/2023

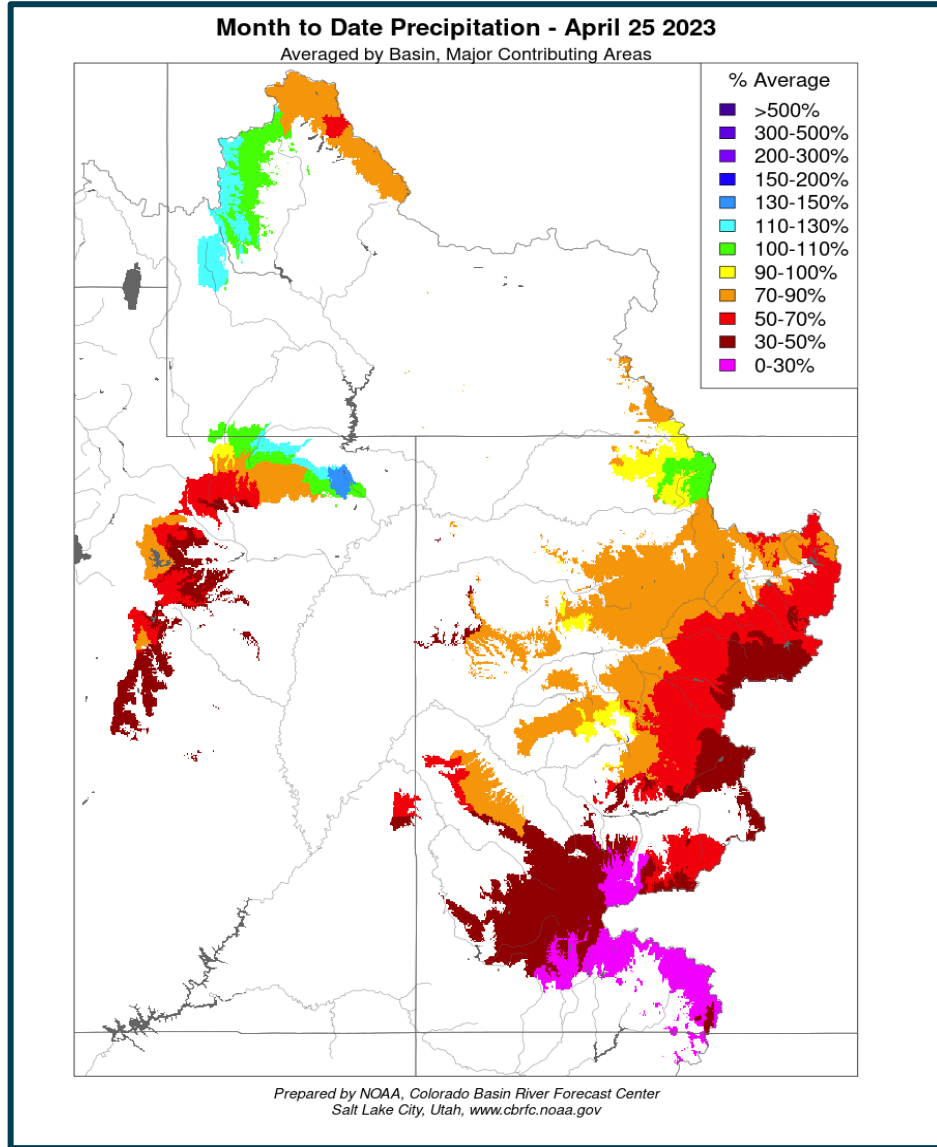
Upper Colorado River Drainage Basin

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	34	0.11	0.33	6,470.06
Flaming Gorge	70	2.56	3.67	6,009.17
Blue Mesa	41	0.34	0.83	7,455.24
Navajo	66	1.08	1.65	6,041.88
Lake Powell	24	5.55	23.31	3,525.06
UC System Storage	33	9.76	29.79	
Total System Storage	33	19.51	58.48	

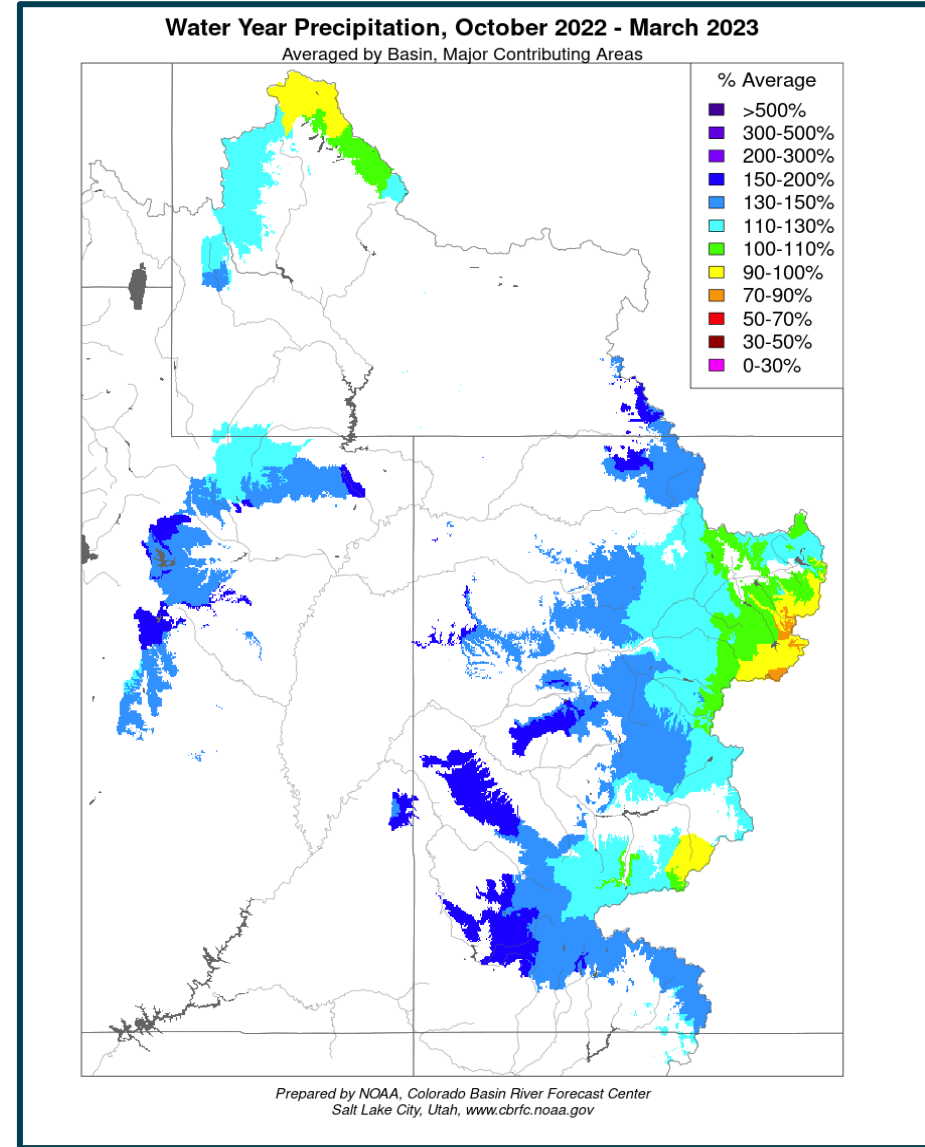


February Month and January WY Precipitation

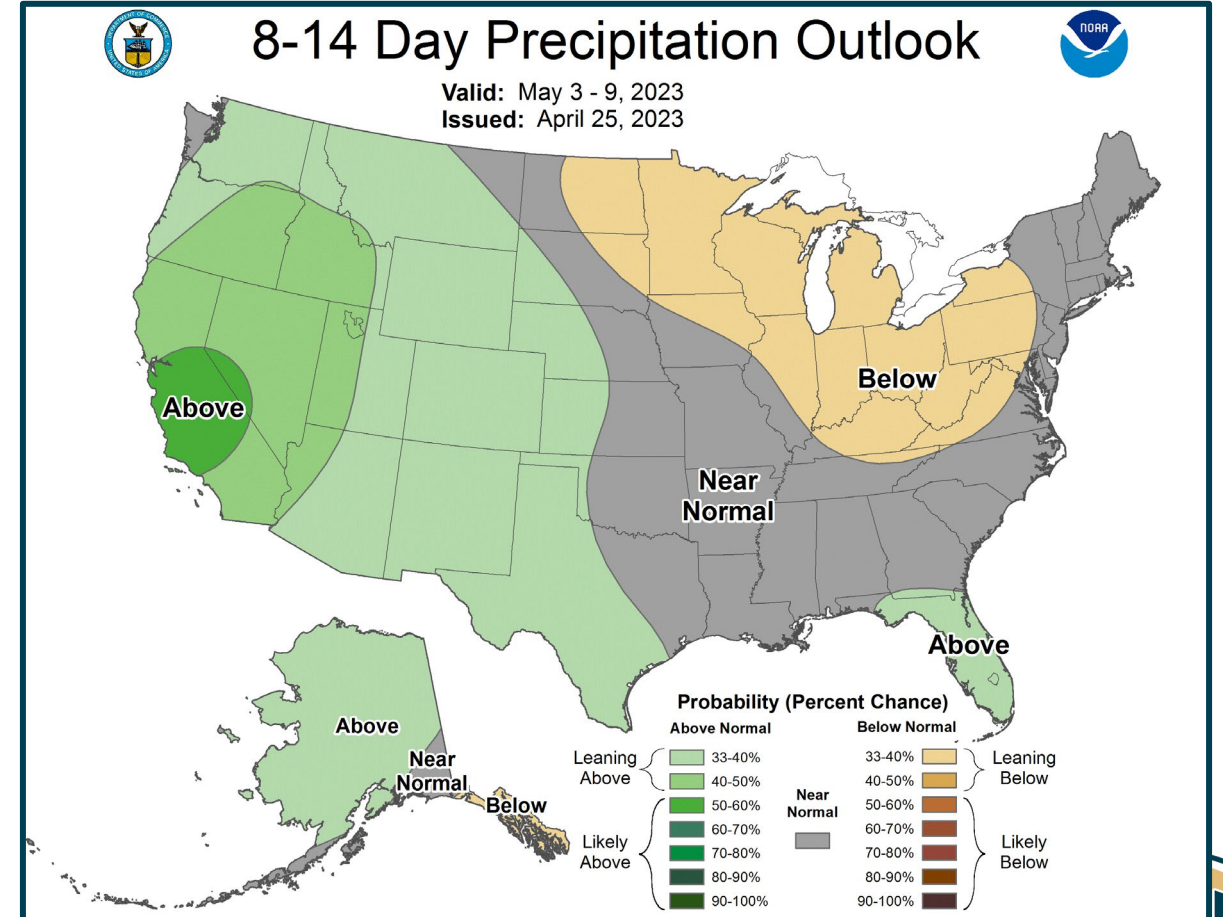
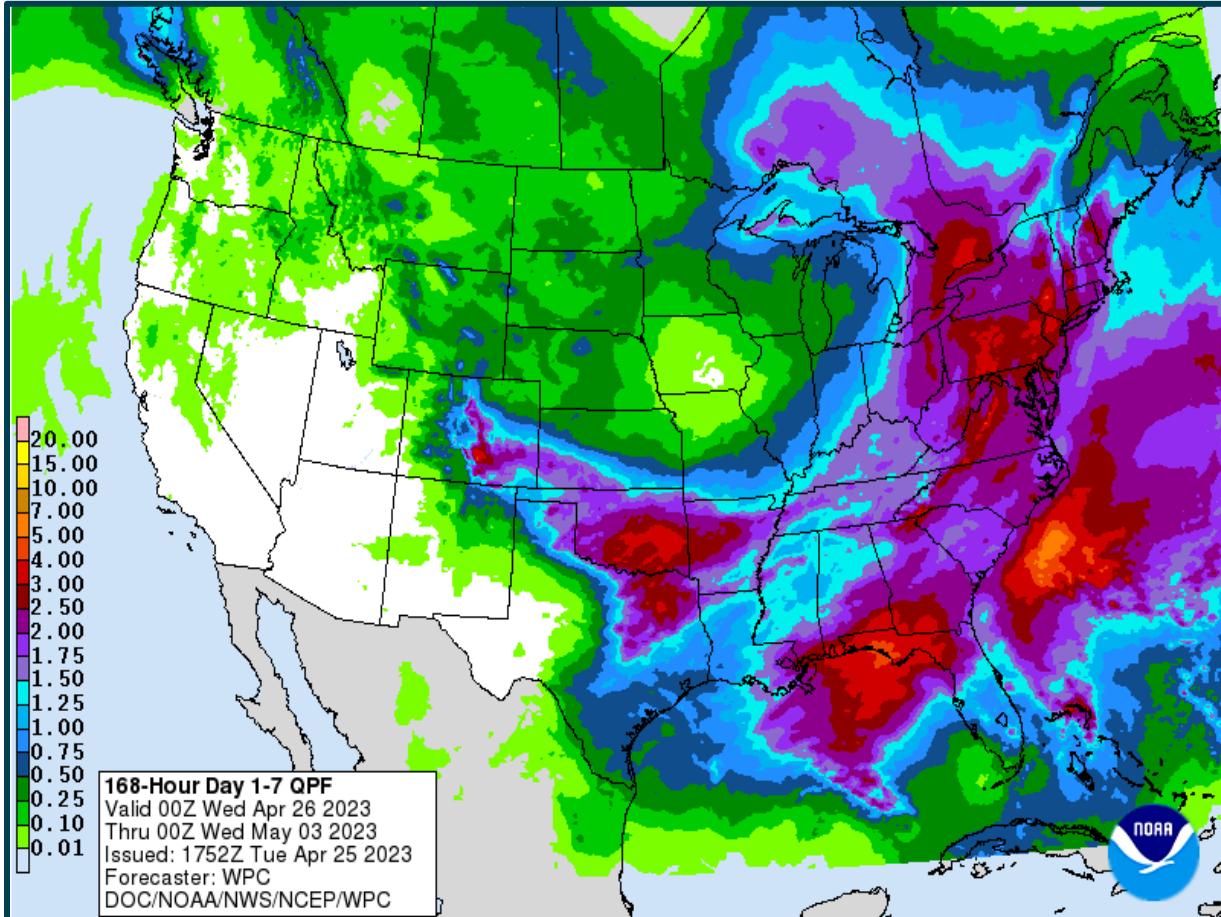
Month to Date Precipitation



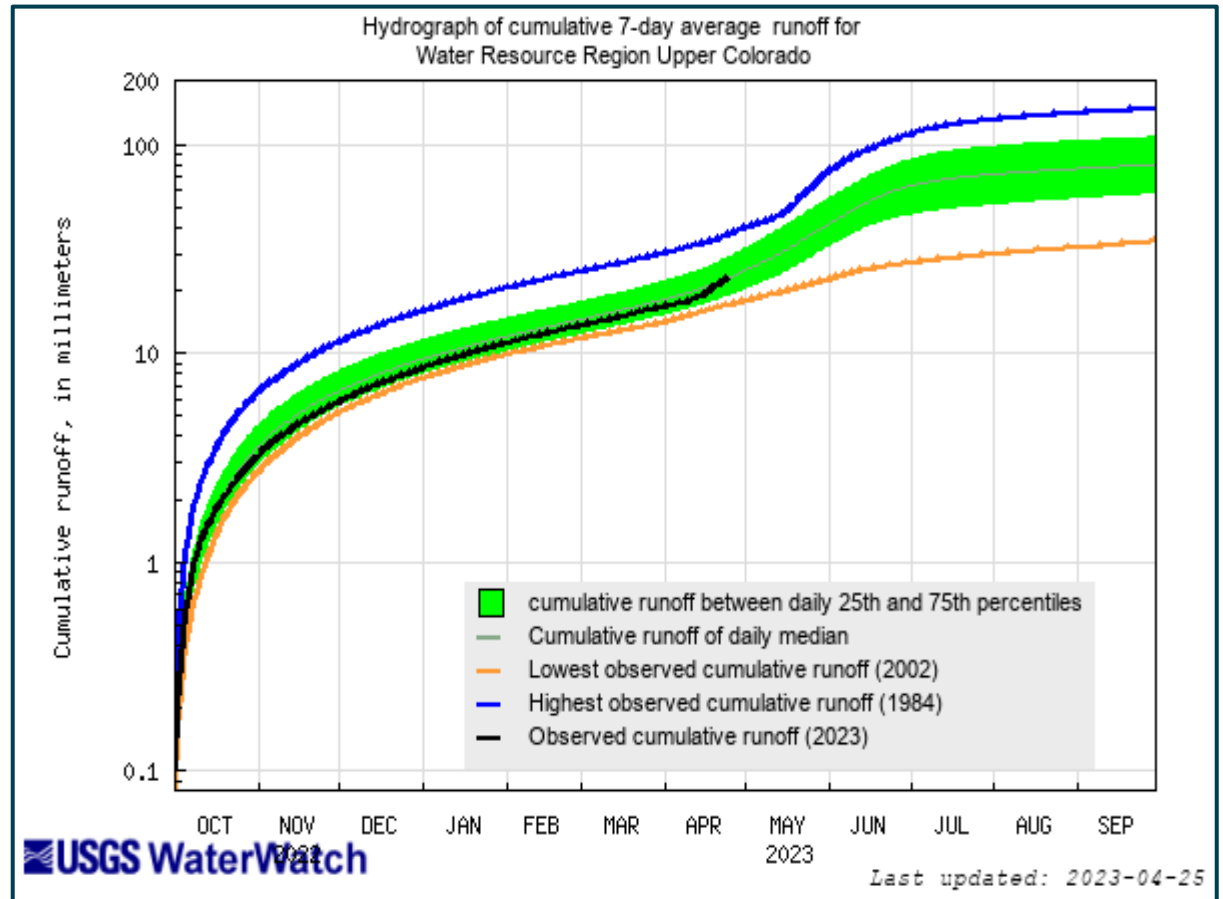
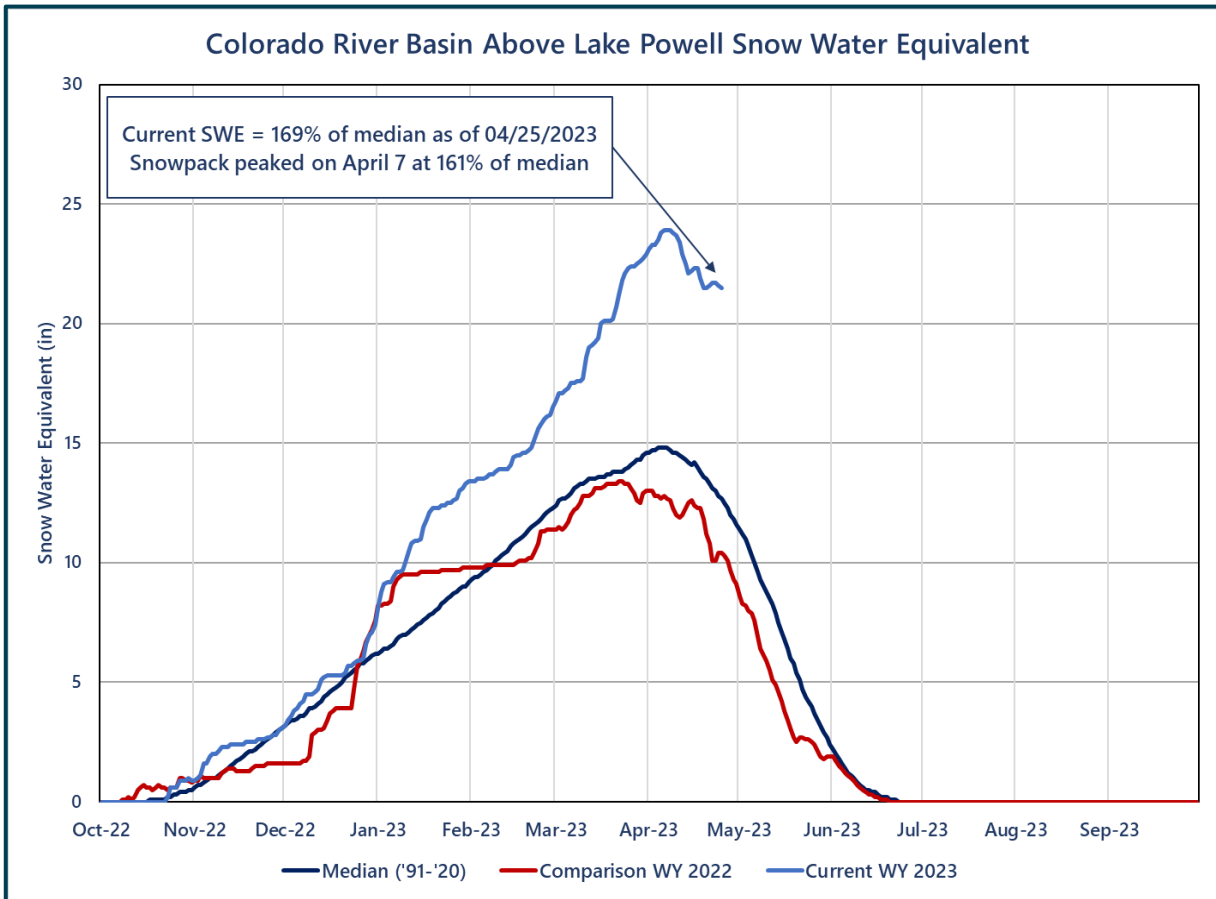
WY Precipitation



Climate Prediction Center Short-Term Precipitation Forecast



Upper Colorado SWE and Observed Inflows



Available online at: https://waterwatch.usgs.gov/index.php?id=wwdur_cumrunoff



Most Probable April Forecast Water Year 2023

April – July 2023
Forecasted Unregulated Inflow
as of April 5, 2023

Reservoir	Inflow (kaf)	Percent of Avg ¹
Fontenelle	800	109
Flaming Gorge	1,200	124
Blue Mesa	850	134
Navajo	945	150
Powell	11,300	177
Midmonth 11,100 kaf (175% of avg)		

Water Year 2023
Unregulated Inflow Forecast
as of April 5, 2023

Reservoir	Inflow (kaf)	Percent of Avg ¹
Fontenelle	1,095	102
Flaming Gorge	1,548	110
Blue Mesa	1,101	122
Navajo	1,195	131
Powell	14,472	151
Midmonth 14,272 kaf (149% of avg)		

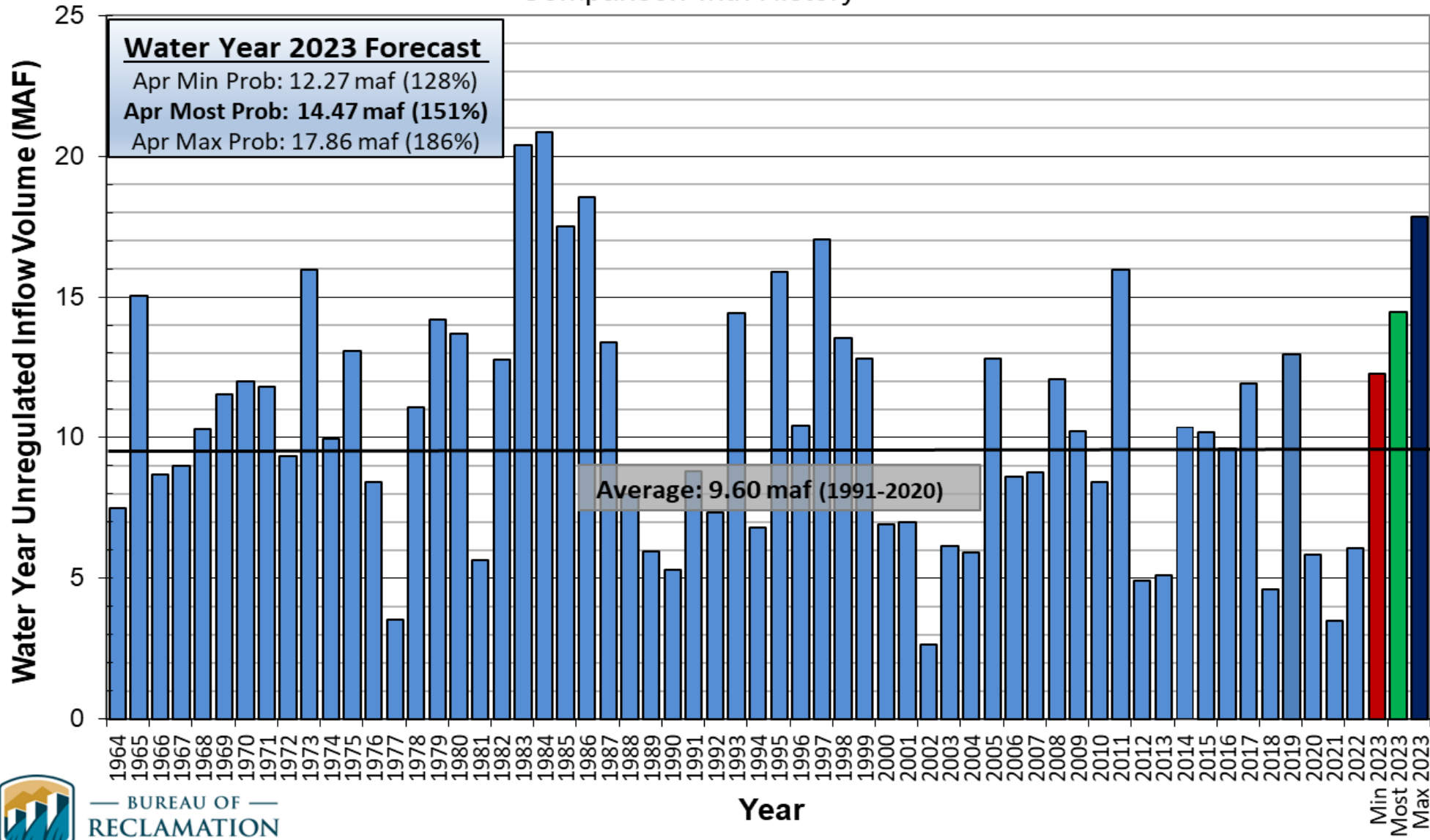
¹Averages are based on the 1991 through 2020 period of record.



Lake Powell Unregulated Inflow

Water Year 2023 Forecast (issued April 5)

Comparison with History





Upper Colorado Basin

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



Drought Response Operations Agreement (DROA)

DROA Volumes Released¹

Reservoir	2021 DROA Volume (kaf)	2022 DROA Volume (kaf)	Total DROA Volume (kaf)
Flaming Gorge	125	463	588
Blue Mesa	36	0	36
Navajo	0	0	0
Volume in Powell	161	463	624

¹DROA operational year is from May through April.



Upper Basin Reservoir Operations in Water Year 2023

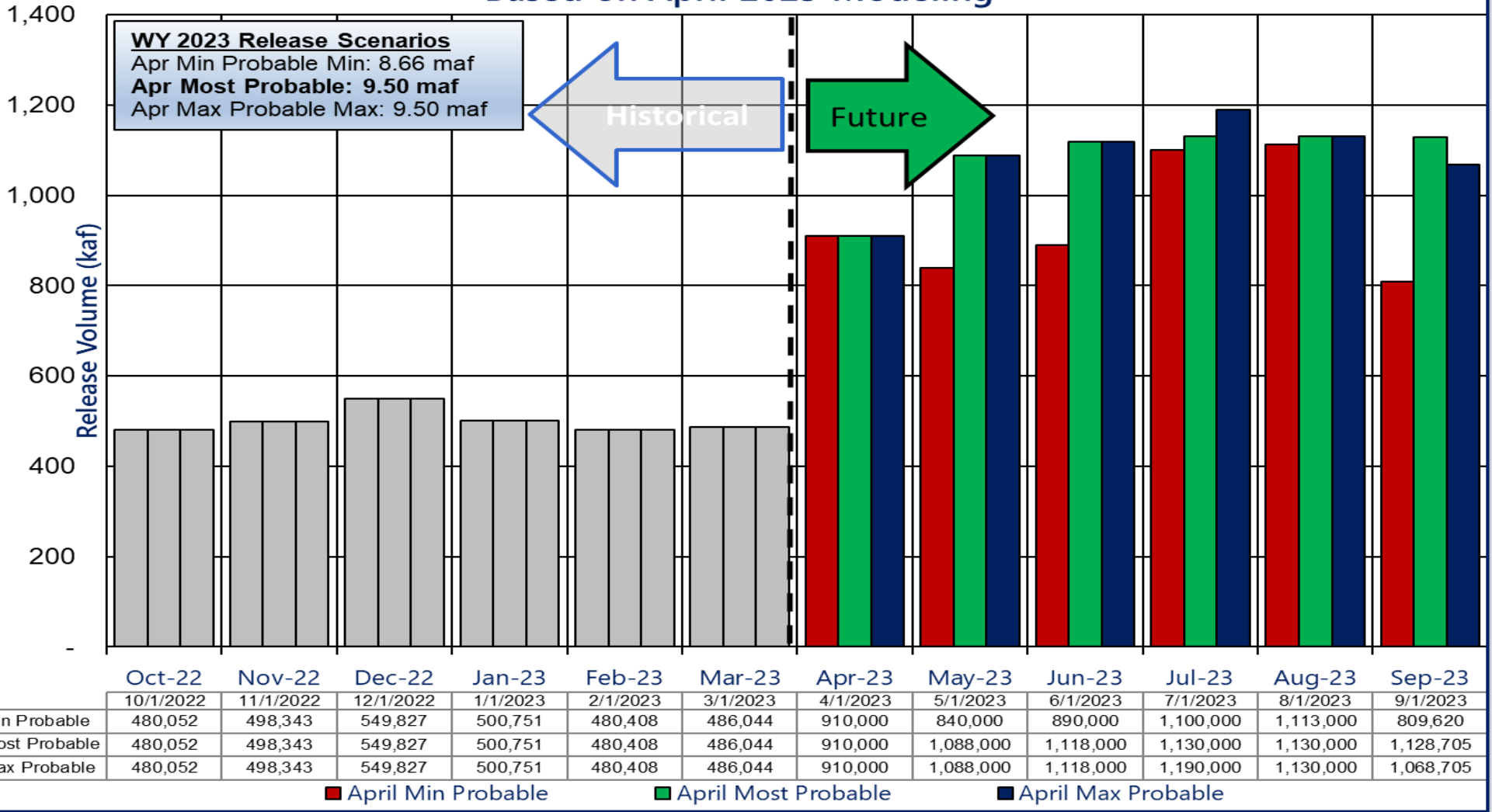
- Lake Powell will be operated consistent with the 2007 Interim Guidelines, the Upper Basin Drought Response Operations Agreement and Upper Basin Records of Decision
- Lake Powell's projected end of calendar year (CY) 2022 "tier determination" elevation in the August 2022 24-Month Study determined Lake Powell's operating tier in water year (WY) 2023
 - Lake Powell will operate in the Lower Elevation Balancing Tier where Lake Powell and Lake Mead will balance contents with Glen Canyon Dam release volumes no less than 7.0 maf and no more than 9.5 maf
- Consistent with the provisions of the 2007 Interim Guidelines, and to preserve the benefits to Glen Canyon Dam facilities from 2022 Operations into 2023 and 2024, Reclamation will consult with the Basin States on monthly and annual operations. 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.
 - The Glen Canyon Dam annual release was initially set to 7.00 maf
 - In April 2023, Reclamation evaluated hydrologic conditions and determined balancing releases are appropriate under the conditions established in the 2007 Interim Guidelines
 - Balancing releases will be limited (with a minimum of 7.00 maf) to protect Lake Powell from declining below elevation 3,525 feet at the end of December 2023. Lake Powell will release between 7.0 MAF and 9.5 MAF in WY 2023
 - Reclamation will remove the operational neutrality of the 0.480 maf that was retained in Lake Powell under the May 2022 action, such that balancing releases are based on the physical storage of Lake Powell and Lake Mead



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2023

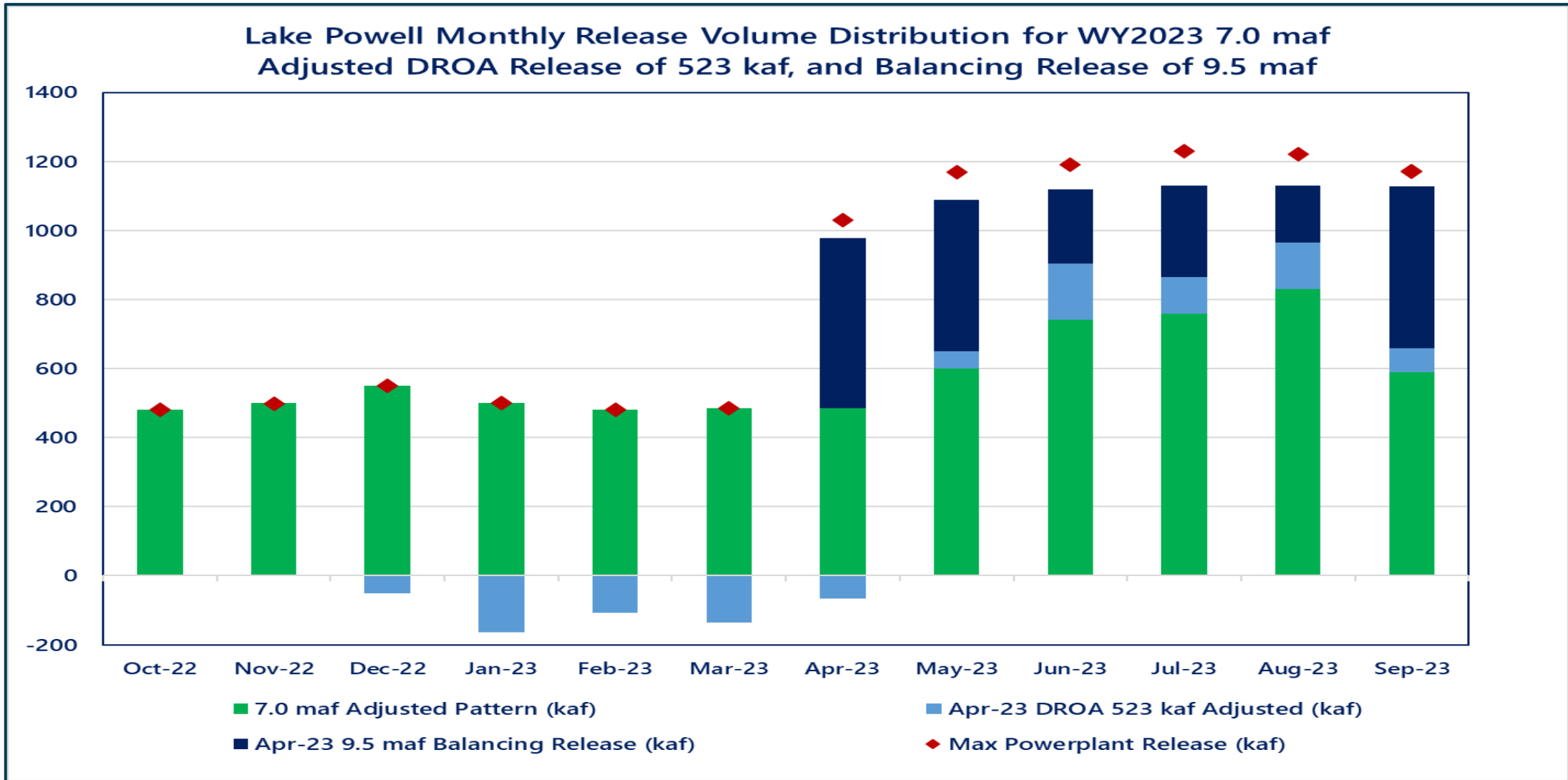
Based on April 2023 Modeling



Consistent with the provisions of the 2007 Interim Guidelines, and to preserve the benefits to Glen Canyon Dam facilities from 2022 Operations into 2023 and 2024, Reclamation will consult with the Basin States on monthly and annual operations. 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.



WY2023 Potential GCD Release of 9.5 maf



	WY2023	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Total
Max Powerplant Release (kaf)		480	498	550	501	480	485	1,030	1,170	1,190	1,230	1,220	1,170	
7.0 maf LTEMP Pattern (kaf)		480	500	600	664	587	620	552	550	577	652	696	522	7,000
April 24MS Min Prob 8.66 maf Pattern (kaf)		480	498	550	501	480	486	910	840	890	1,100	1,113	810	8,658
9.0 maf Release (kaf)		480	498	550	501	480	486	910	1,036	1,029	1,130	1,130	770	9,000
April-23 9.5 maf Release (kaf)		480	498	550	501	480	486	910	1,088	1,118	1,130	1,130	1,129	9,500



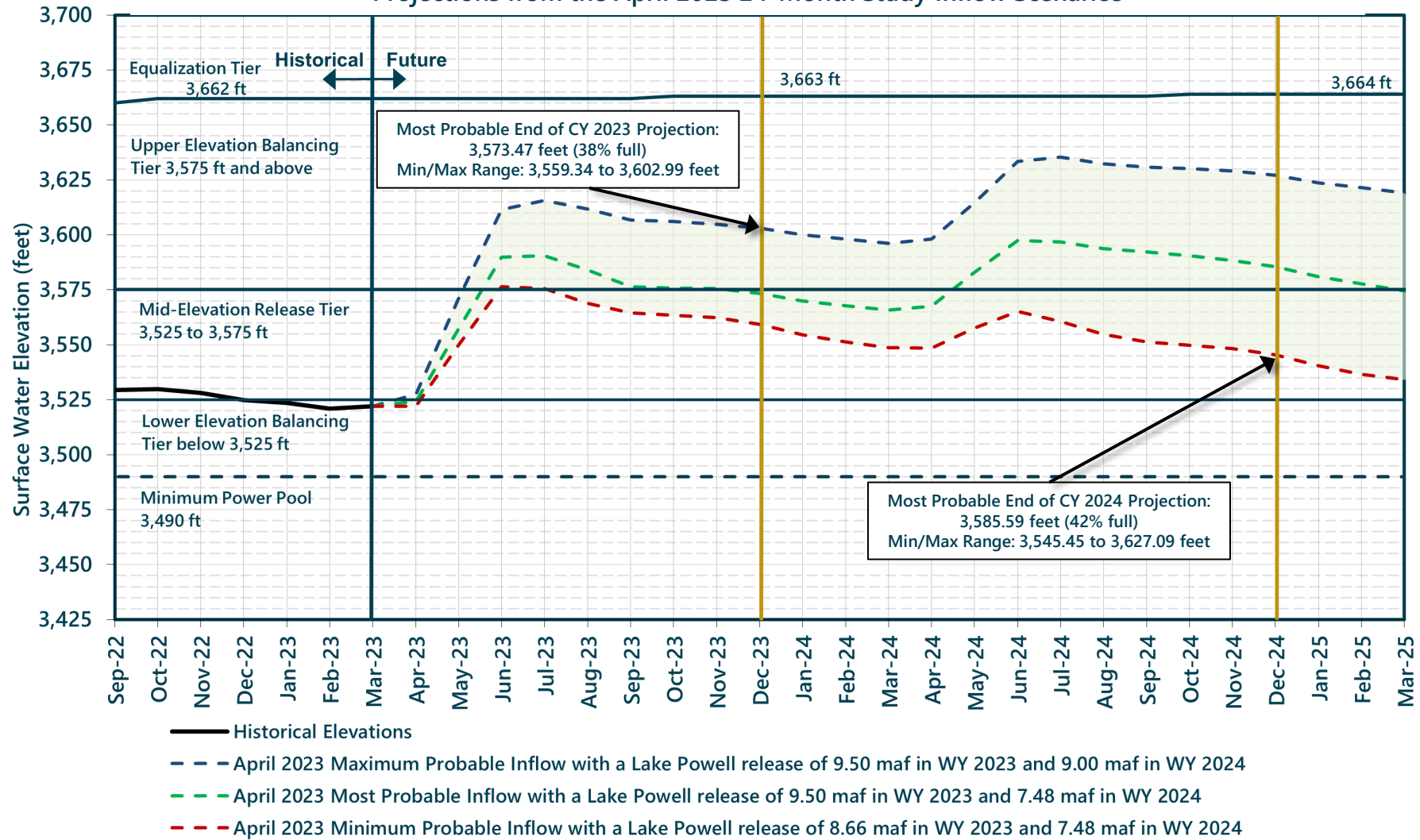
Reclamation Operational Modeling Model Comparison

	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 Elevations¹

Projections from the April 2023 24-Month Study Inflow Scenarios



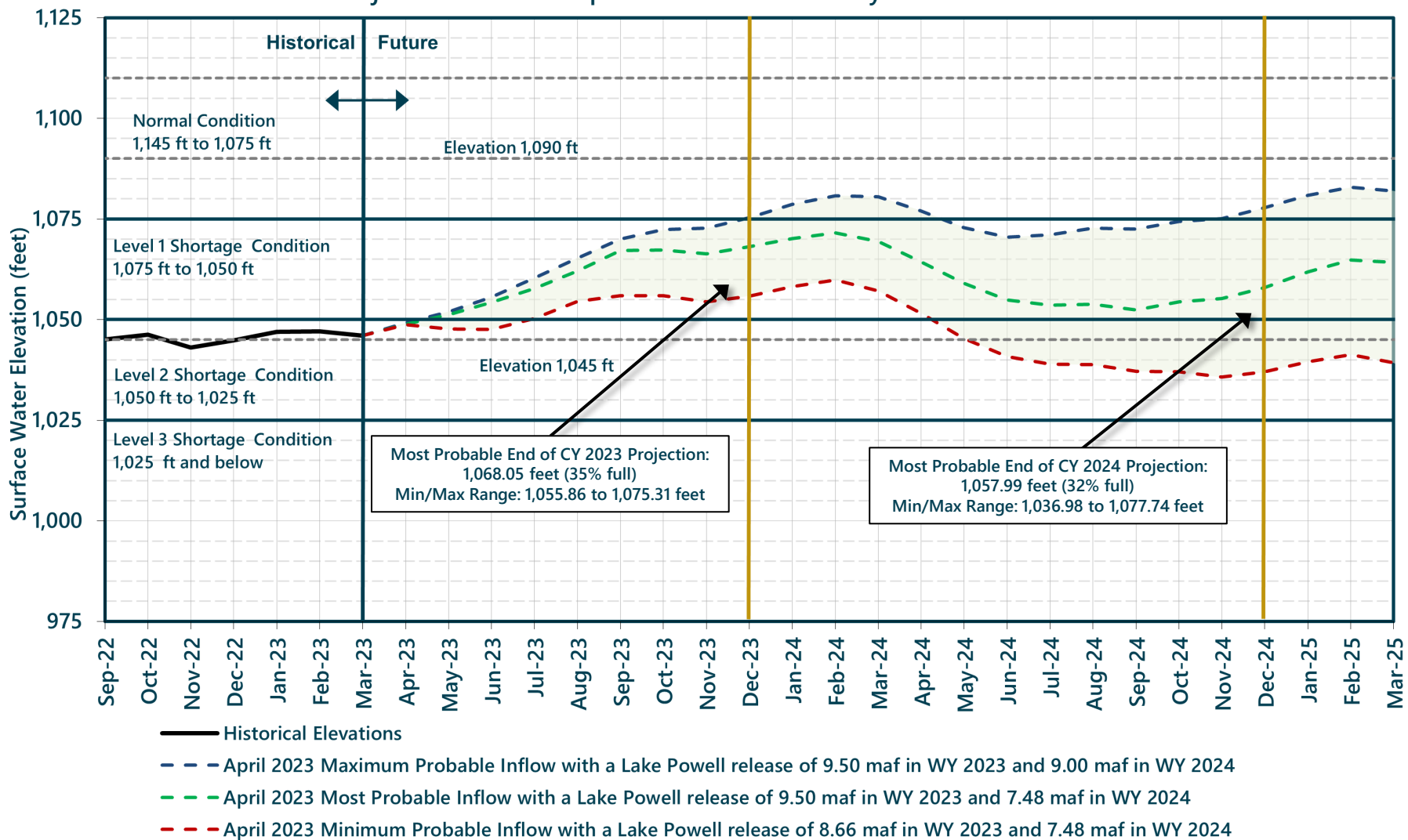
¹ Projected Lake Mead end of month physical elevations from the latest 24-Month Study inflow scenarios. The Drought Response Operations Agreement (DROA) is available online at: <https://www.usbr.gov/dcp/finaldocs.html>.

The chart above displays projected “physical” elevations for Lake Powell.



Lake Mead End of Month Elevations¹

Projections from the April 2023 24-Month Study Inflow Scenarios



¹ Projected Lake Mead end of month physical elevations from the latest 24-Month Study inflow scenarios.
The Drought Response Operations Agreement (DROA) is available online at: <https://www.usbr.gov/dcp/finaldocs.html>.

The chart above displays projected physical elevations for Lake Mead.





Upper Colorado Basin

Hydropower Maintenance



Glen Canyon Dam Power Plant Unit Outage Schedule for 2023

Unit Number	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023	Sep 2023
1												
2												
3								[Outage Bar]				
4								[Outage Bar]				
5	[Outage Bar]											
6	[Outage Bar]											
7						[Outage Bar]						
8						[Outage Bar]						
Units Available	6	6	6	6	6	6	8	6	6	6	6	6
Capacity (cfs)	18,200	18,150	18,050	18,000	17,919	17,900	24,500	19,100	20,000	20,000	19,800	19,600
Capacity (kaf/month)	1,120	1,080	1,110	1,110	970	1,090	1,030	1,170	1,190	1,230	1,220	1,170
Max (kaf) ¹	480	498	549	980	870	698	910	1,088	1,118	1,190	1,130	1,069
Most (kaf) ¹	480	498	549	501	480	485	910	1,088	1,118	1,130	1,130	1,129
Min (kaf) ¹	480	498	549	501	480	485	910	840	890	1,100	1,113	810
										(updated 04-25-2023)		

APR MOST²

APR MOST

9.50 maf

9.50 maf

8.66 maf

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

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



Glen Canyon Dam Power Plant Unit Outage Schedule for WY2024

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	■											■
2	■											■
3	■	■	■	■	■	■	■					
4	■	■	■	■	■							
5						■		■				
6						■		■				
7							■	■				
8							■	■				
Units Available	4	6	6	6	6	6	5	4	8	8	8	6
Capacity (cfs)	12,400	19,600	19,500	19,400	19,400	19,300	15,800	12,500	27,500	27,500	27,400	20,000
Capacity (kaf/month)	780	1,170	1,200	1,190	960	1,130	1,110	980	1,640	1,690	1,680	1,260
Max (kaf) ¹	643	642	715	857	758	801	713	710	745	842	900	674
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

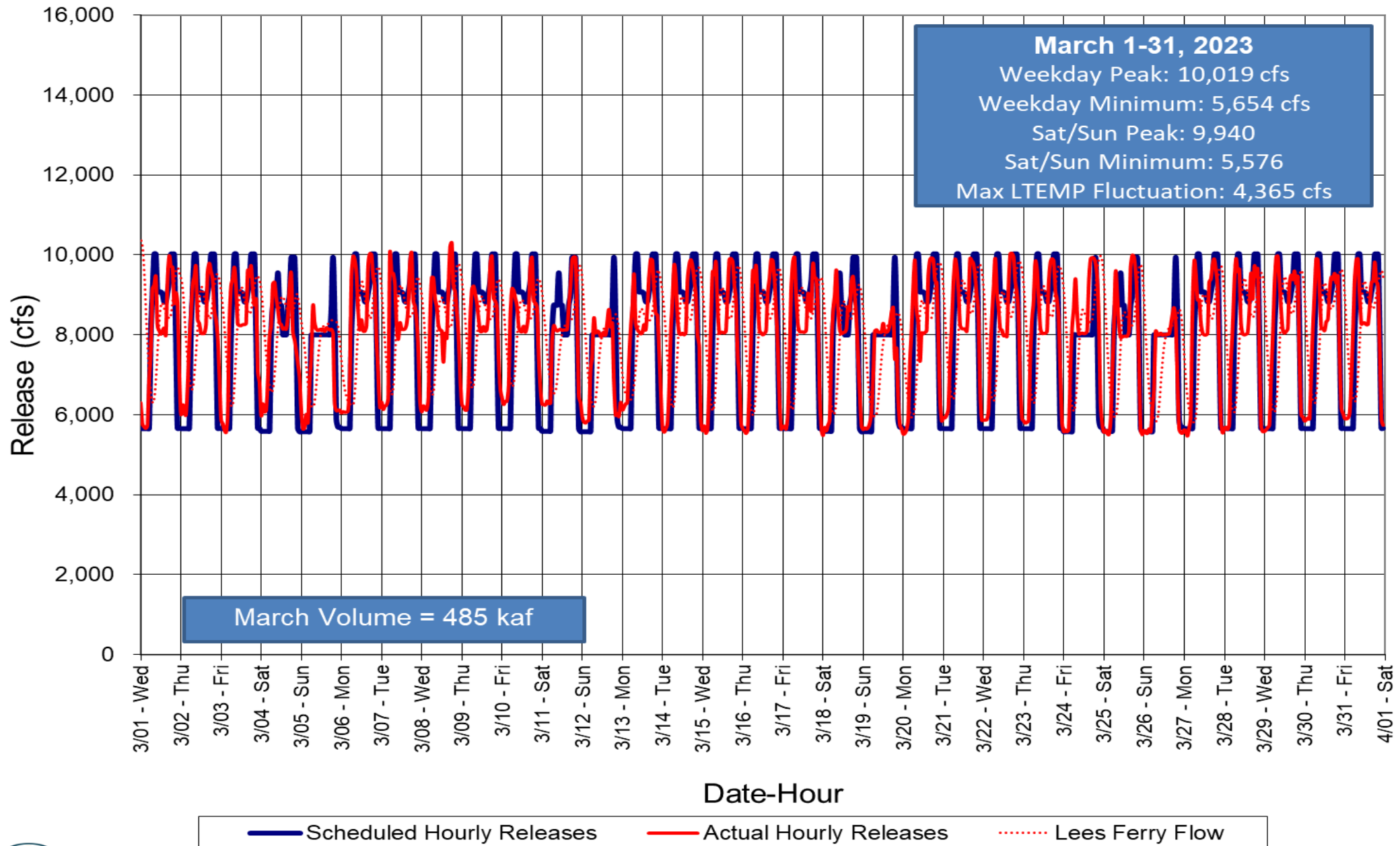
APR MOST²
 APR MOST
 9.00 maf
 7.48 maf
 7.48 maf

(updated 04-25-2023)

1 Projected release, based on April 2023 24MS for the minimum, most and maximum probable inflow projections and 24-Month Study model runs.
 2 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.

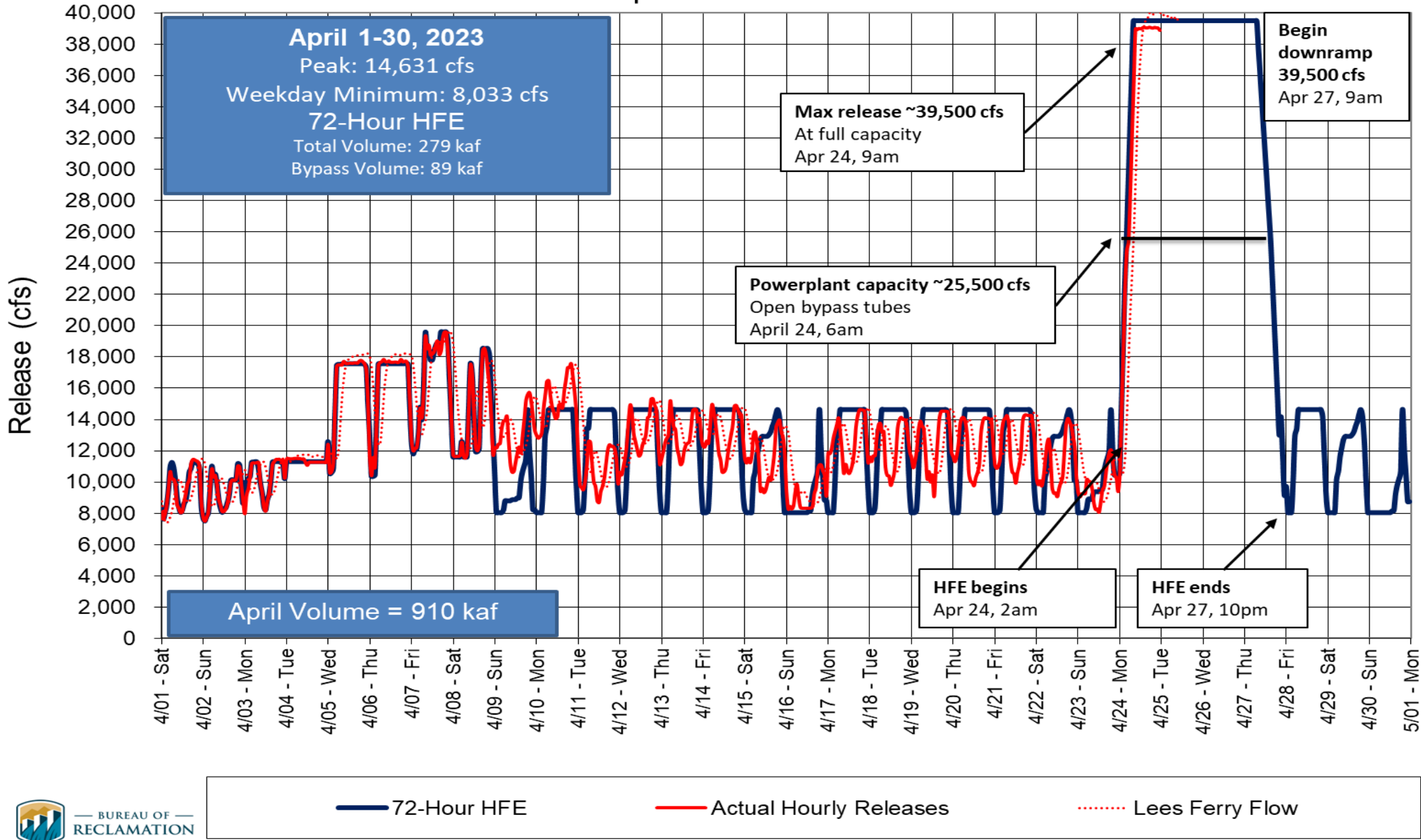


Glen Canyon Dam Hourly Release Pattern March 2023



Glen Canyon Dam Hourly Release Pattern April 2023

Compare HFE Patterns

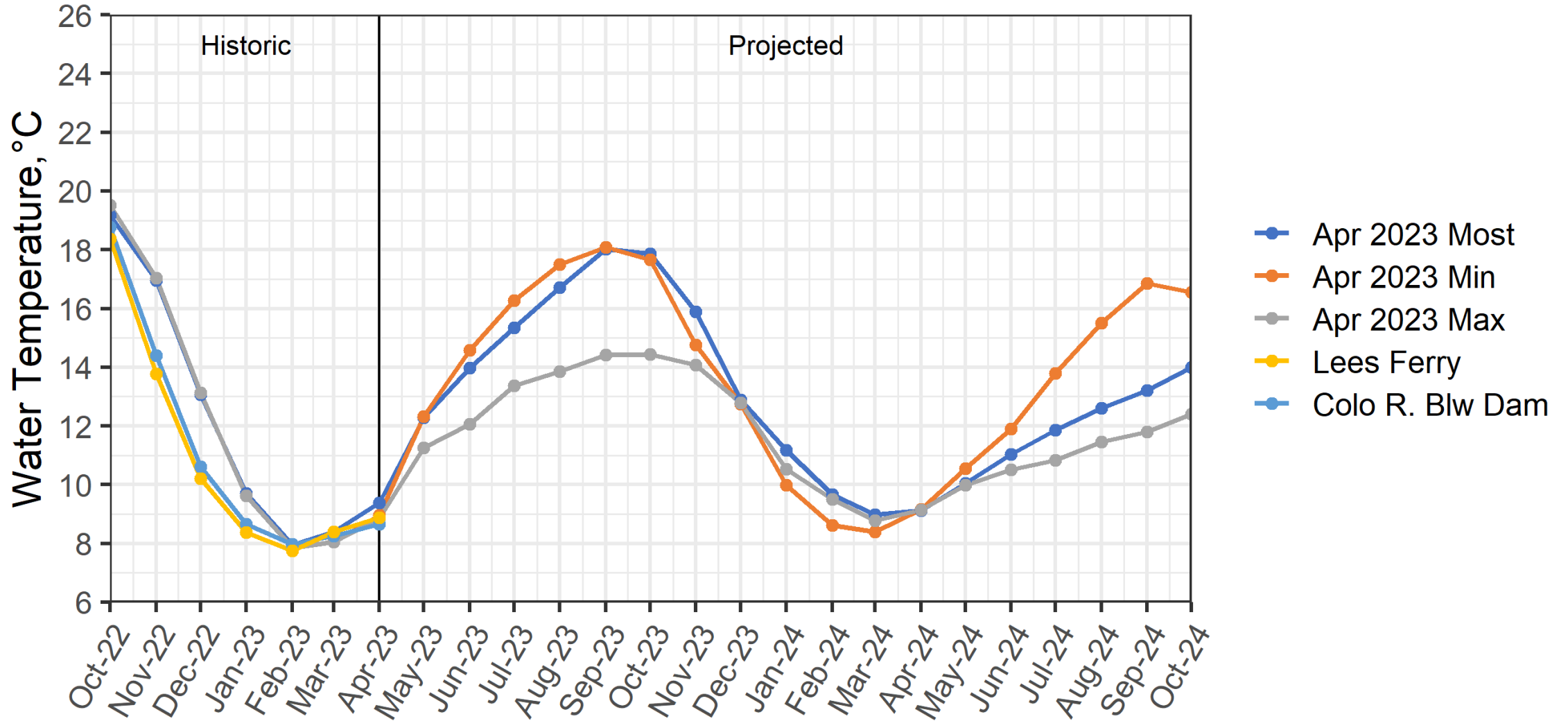


Water Quality



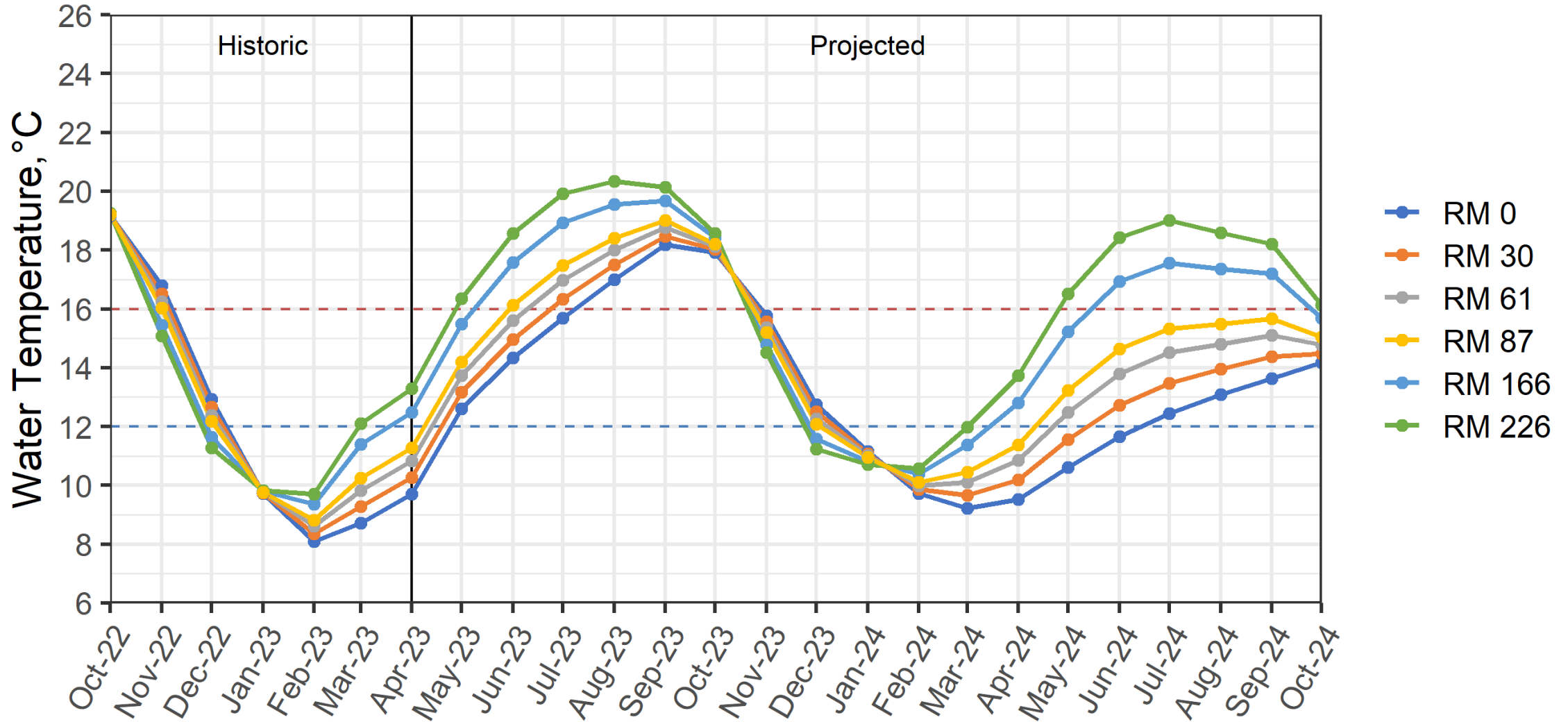
Lake Powell Release Temperature

Projected Temperature based on April 2023 Forecast



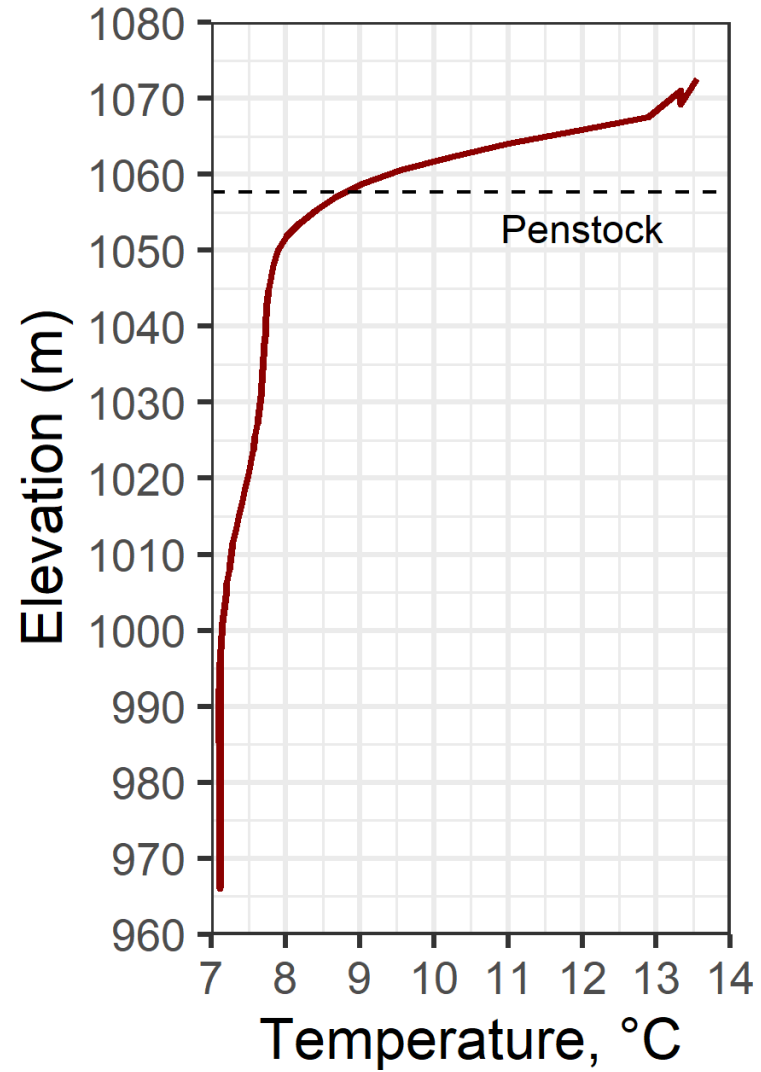
Colorado River, Grand Canyon Water Temperature

Projected Temperature based on April 2023 Forecast



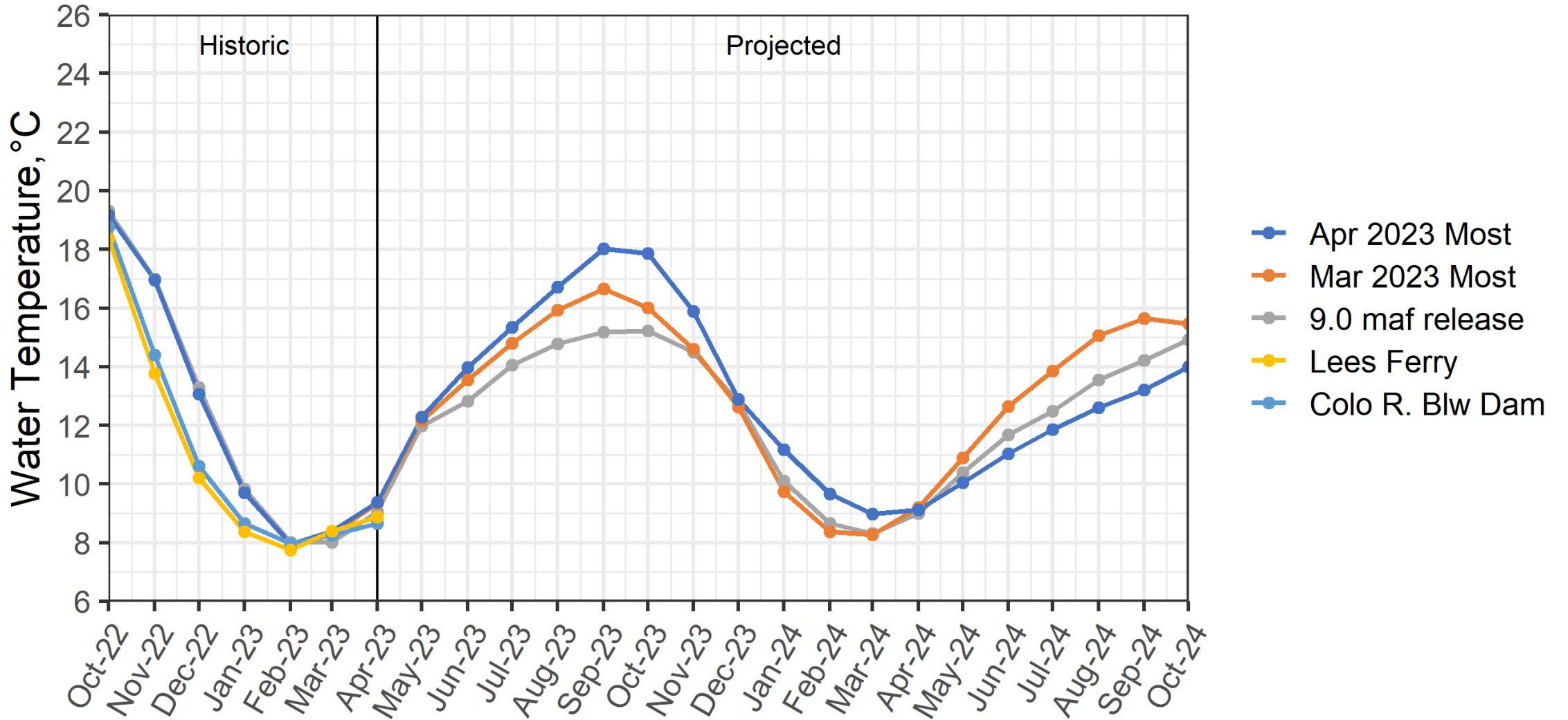
Powell Forebay

April 21, 2023



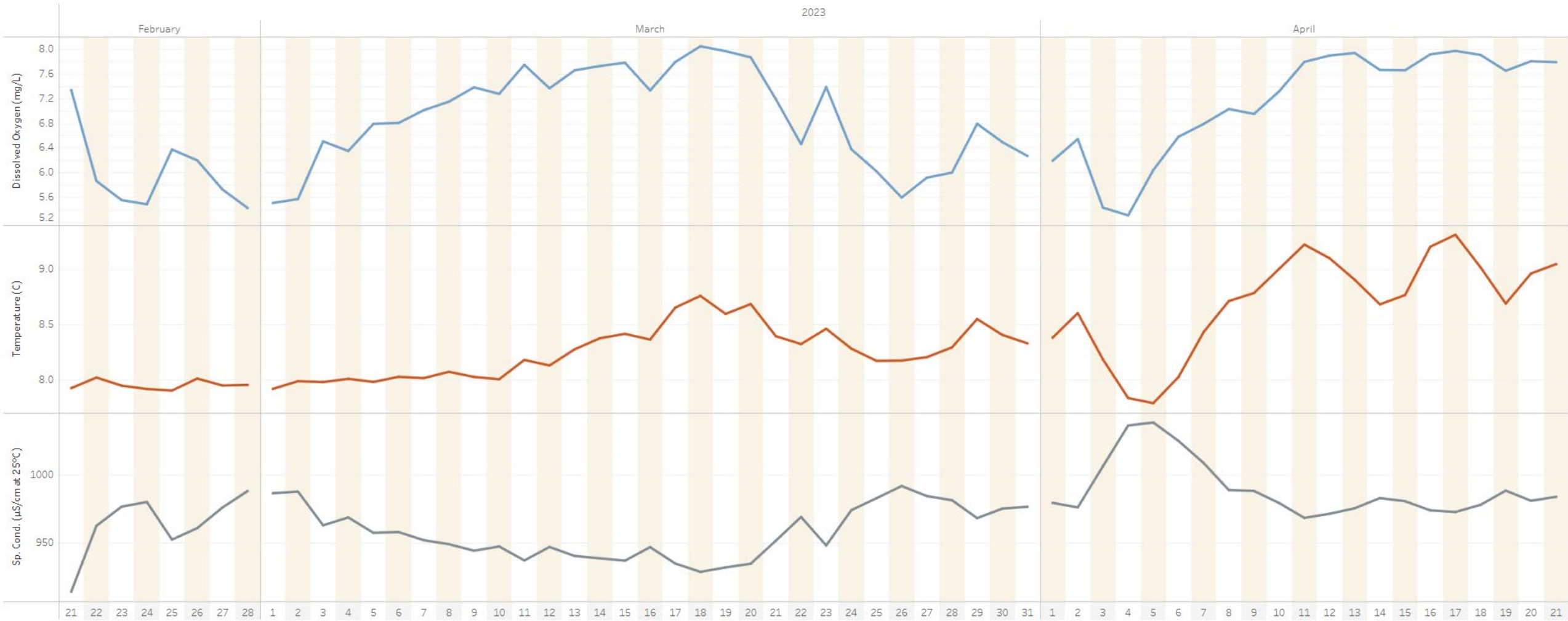
Lake Powell Release Temperature

Comparison of March and April Projections



Water Quality at Glen Canyon Dam last 60 days

Daily Dissolved Oxygen & Temperature Values



Data Source: [Daily Water Quality at Glen Canyon Dam \(provisional\)](#)

Questions?



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RECLAMATION