



— BUREAU OF —
RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

March 19, 2024

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.”

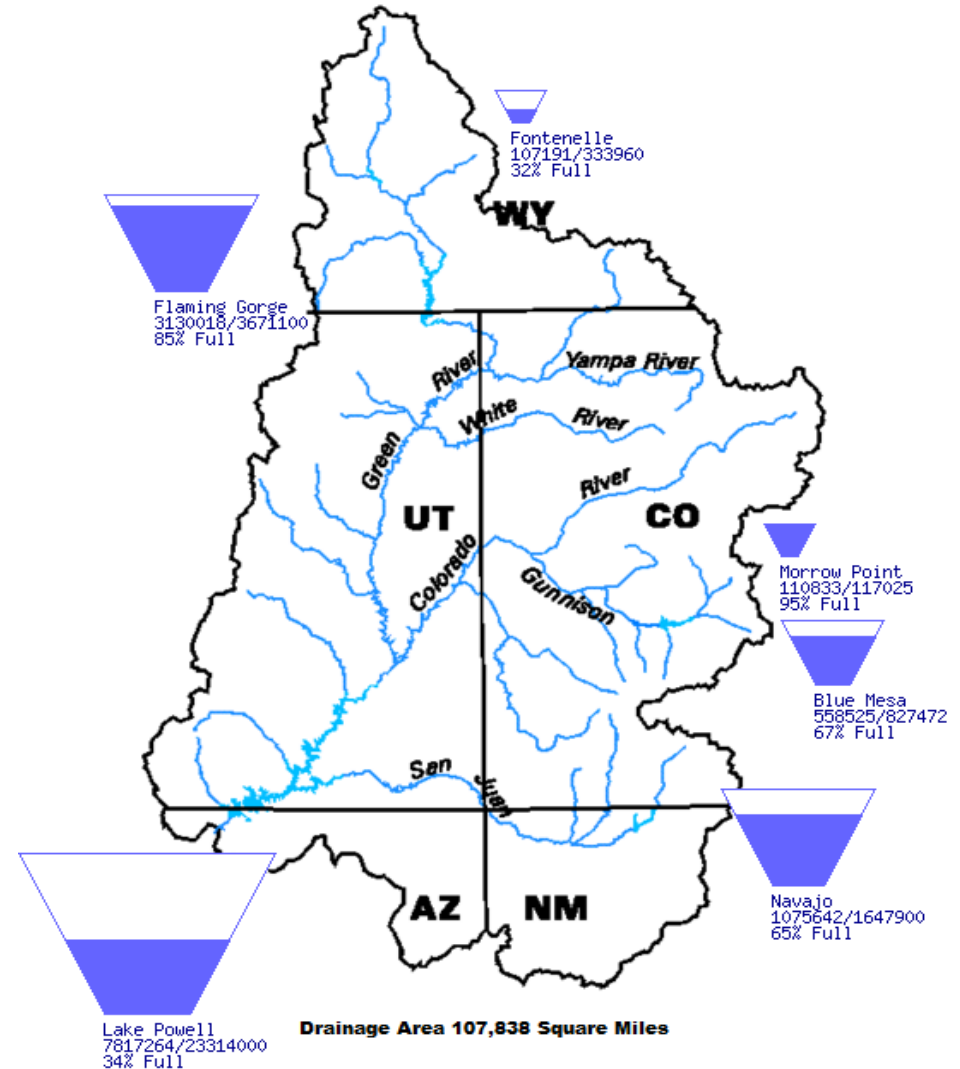


Upper Basin Storage (as of March 18, 2024)

Data Current as of:
03/17/2024

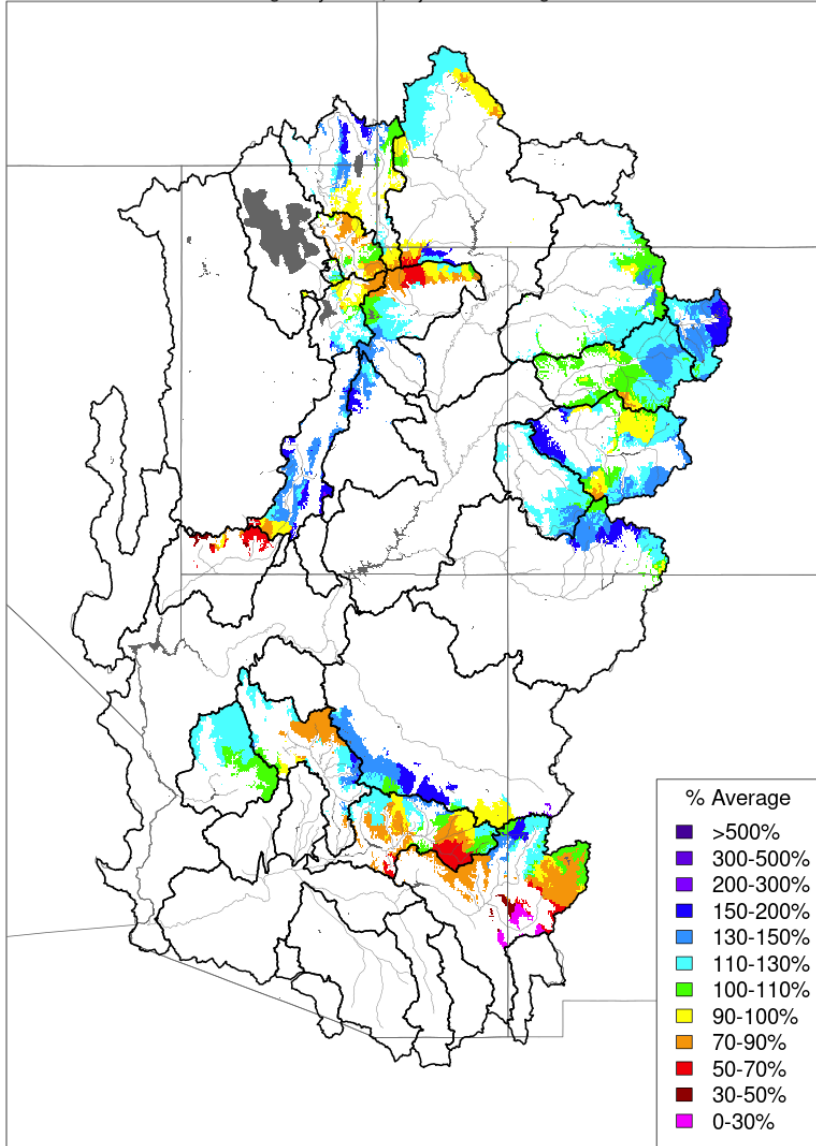
Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	32	0.11	0.33	6,468.48
Flaming Gorge	85	3.13	3.67	6,026.41
Blue Mesa	68	0.56	0.83	7,487.56
Navajo	65	1.08	1.65	6,041.43
Lake Powell	33	7.81	23.31	3,560.43
UC System Storage	43	12.81	29.93	
Total System Storage	42	24.72	58.48	

Upper Colorado River Drainage Basin



Month to Date Precipitation - March 19 2024

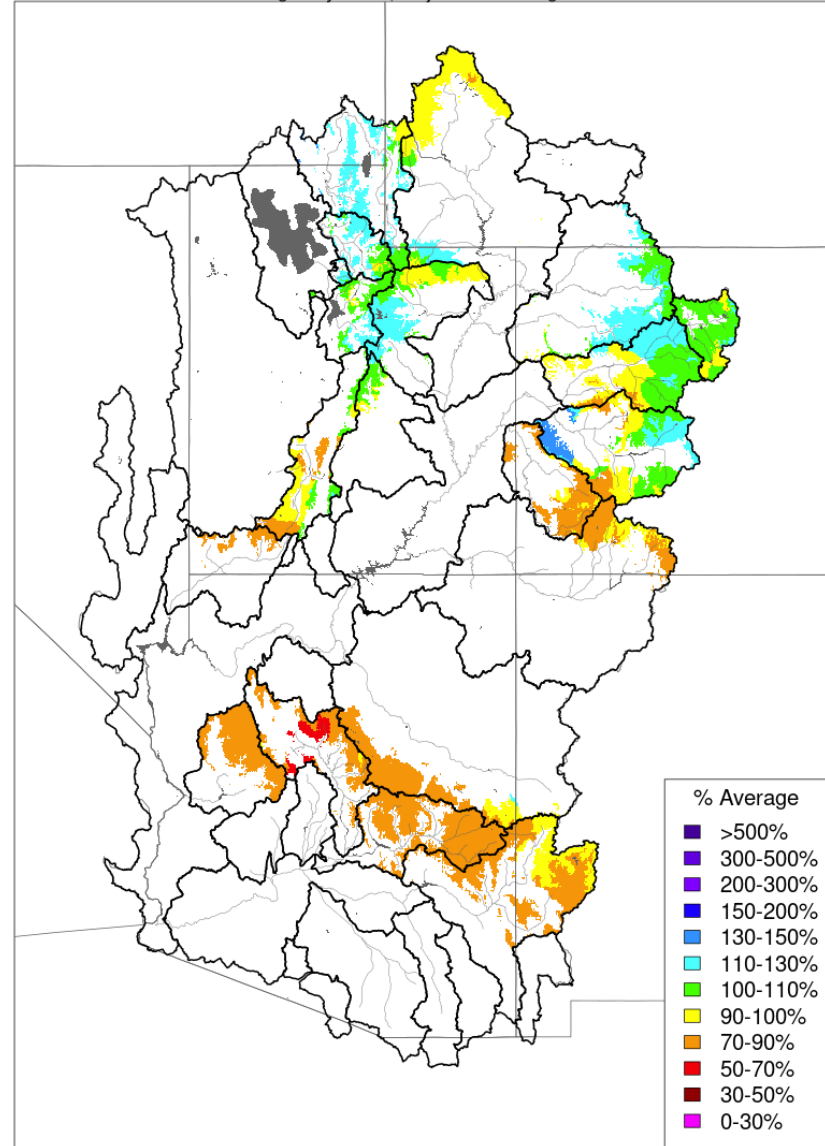
Averaged by Basin, Major Contributing Areas



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

Water Year to Date Precipitation, October 01 - March 18 2024

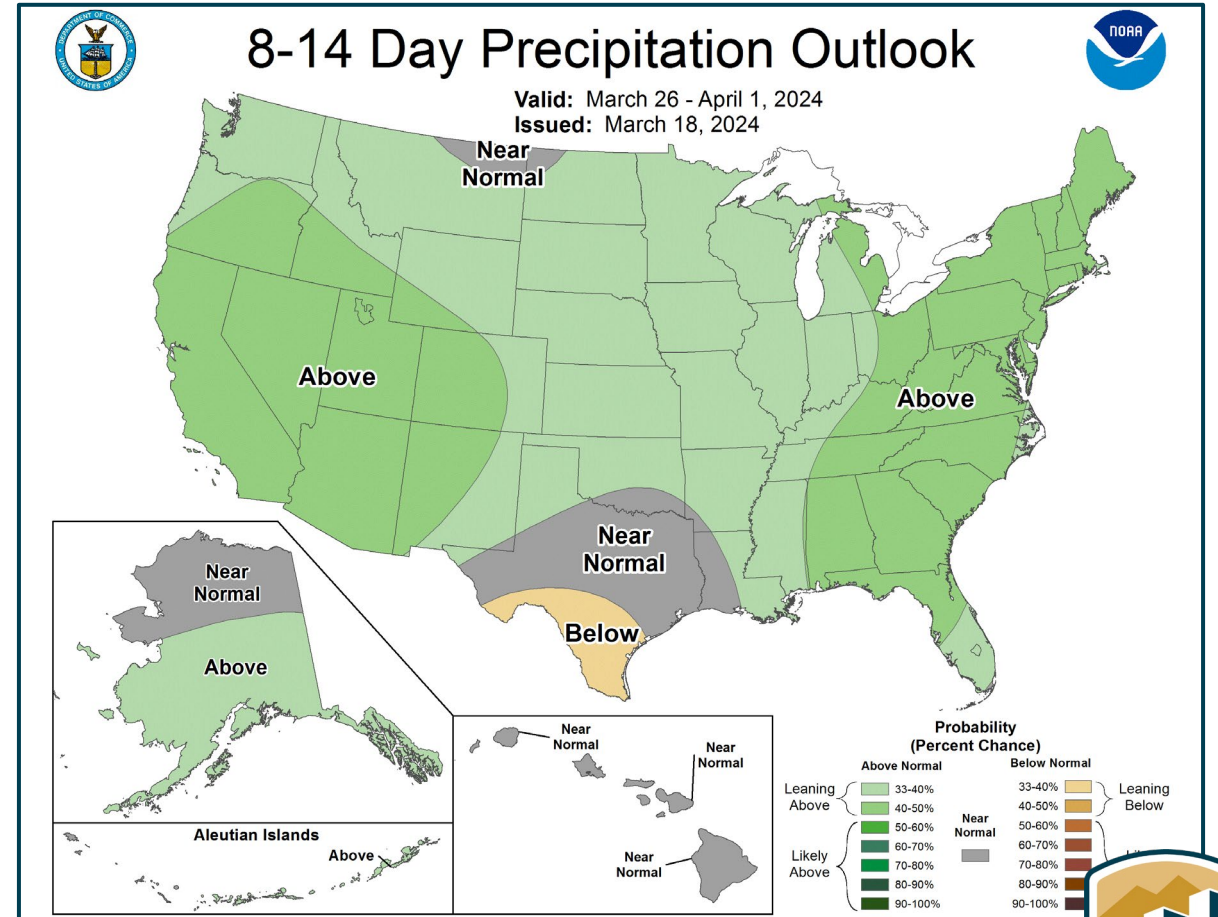
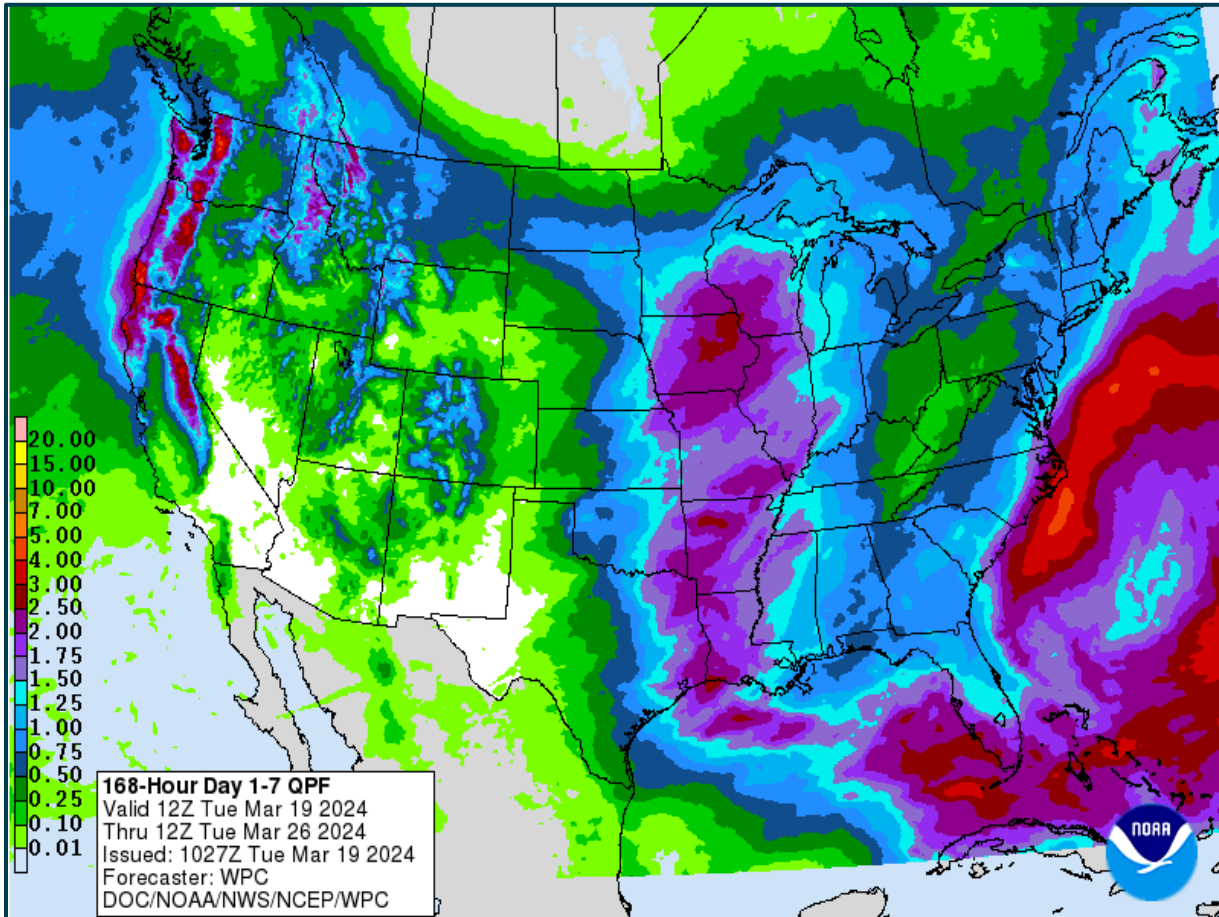
Averaged by Basin, Major Contributing Areas



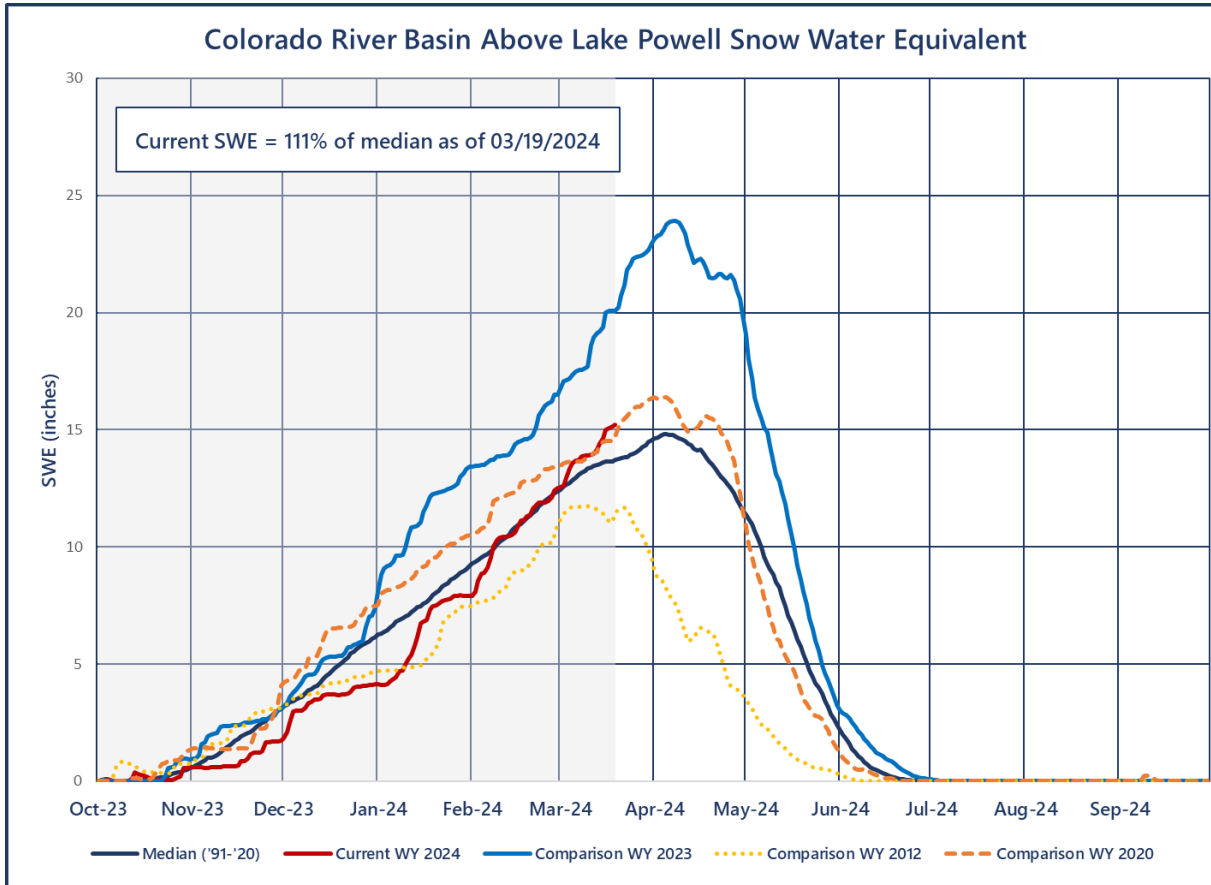
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov



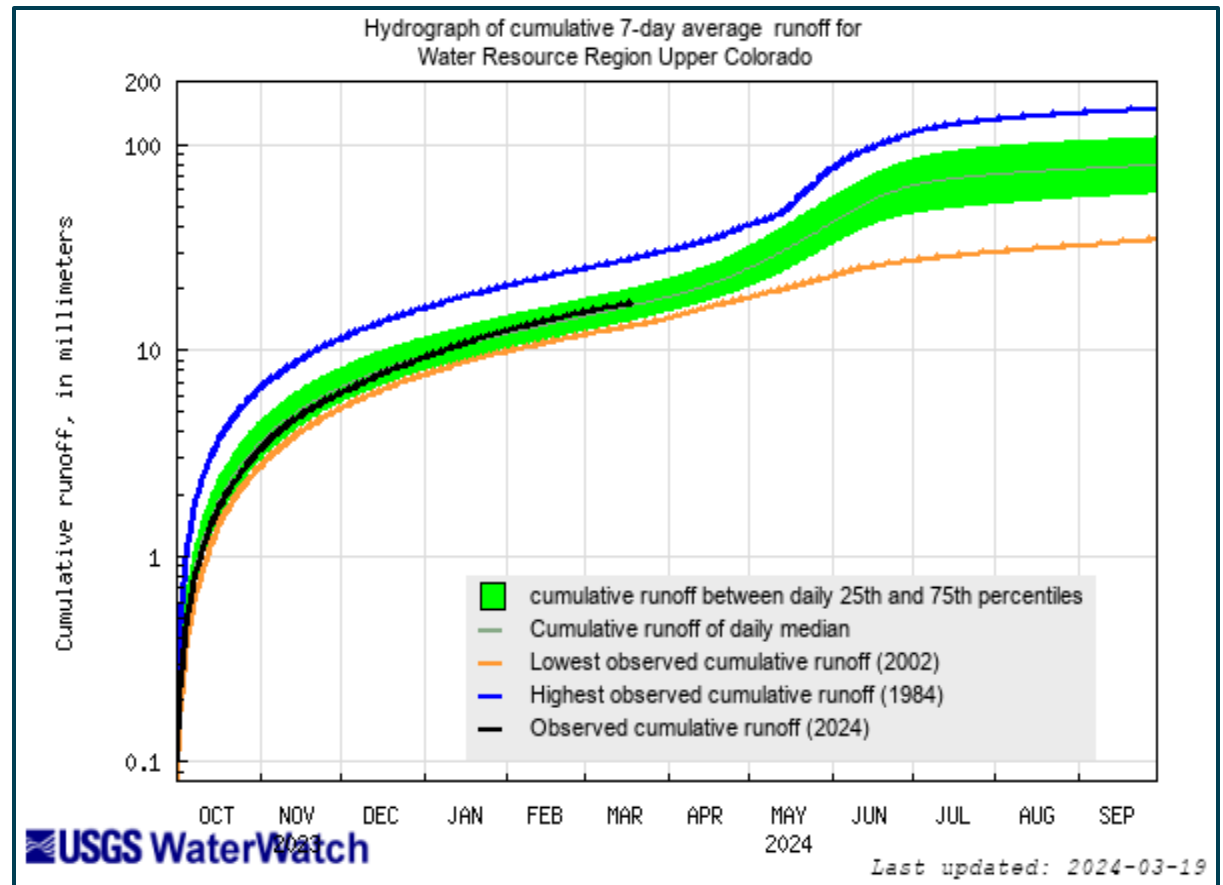
Weather Prediction Center and Climate Prediction Center Precipitation Forecasts



Upper Colorado SWE & Observed Runoff



https://nwcc-apps.sc.egov.usda.gov/awdb/basin-plots/POR/WTEQ/assocHUC2/14_Upper_Colorado_Region.html



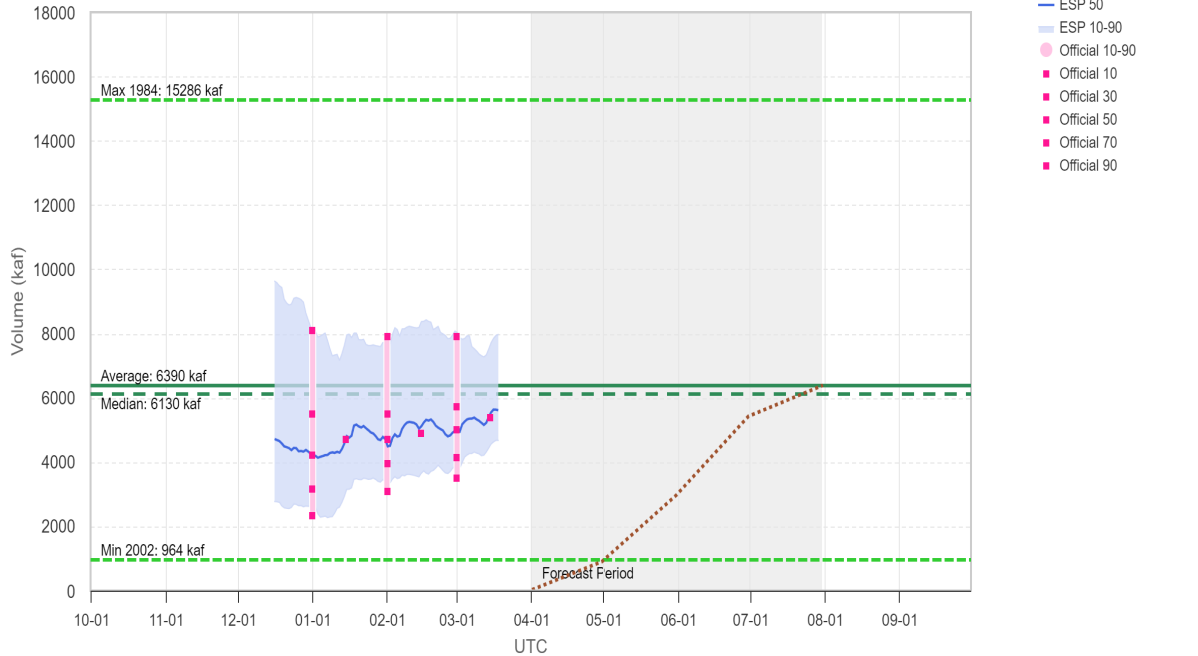
<https://waterwatch.usgs.gov/index.php>



WY2024 Comparison with WY2020 Forecast Progression

2024 Water Supply Forecast - Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)

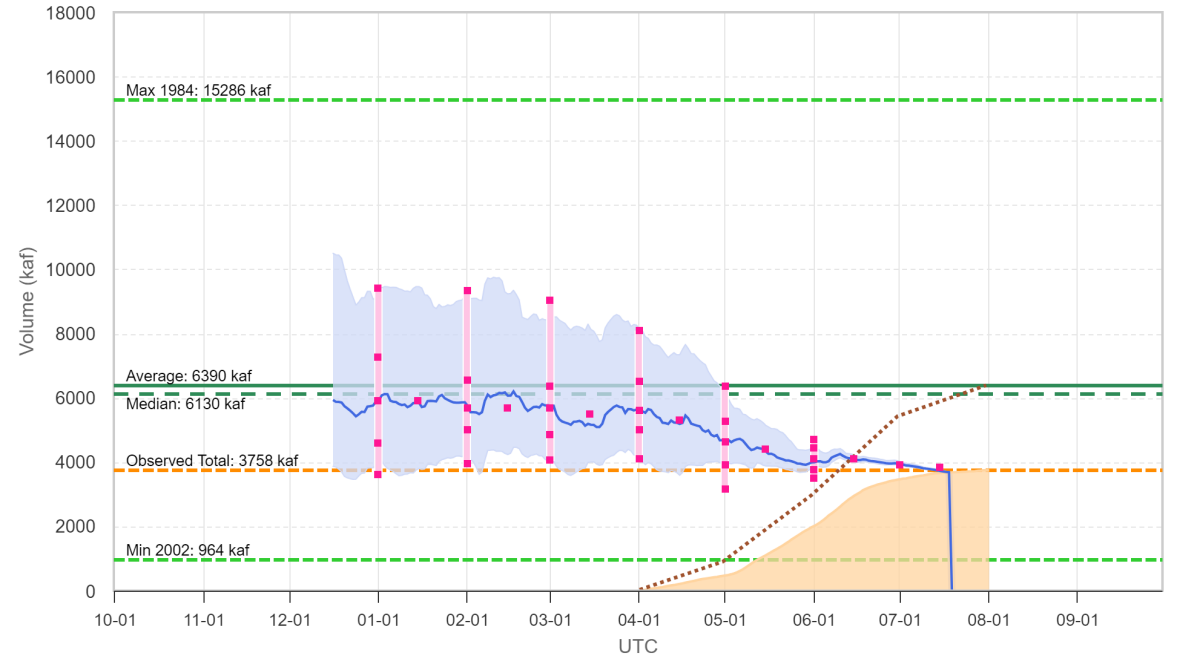
ESP is Unregulated and No Precipitation Forecast Included
 Official 50% Fcst (2024-03-15): 5400 kaf (85% Avg, 88% Med), (40% of Yrs Below Fcst, 37 Highest Flow / 60 Tot Yrs)
 ESP 50% Fcst (2024-03-18): 5614 kaf (88% Avg, 92% Med), (41% of Yrs Below Fcst, 36 Highest Flow / 60 Tot Yrs)
 No Observed



NOAA / Colorado Basin River Forecast Center / 2024-03-19 14:21Z

2020 Water Supply Forecast - Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)

ESP is Unregulated and No Precipitation Forecast Included
 Official 50% Fcst (2020-07-15): 3840 kaf (60% Avg, 63% Med), (18% of Yrs Below Fcst, 50 Highest Flow / 60 Tot Yrs)
 ESP 50% Fcst (2020-07-30): 3586 kaf (56% Avg, 59% Med), (16% of Yrs Below Fcst, 51 Highest Flow / 60 Tot Yrs)
 Observed Volume: 3758 kaf (59% Average, 61% Median)

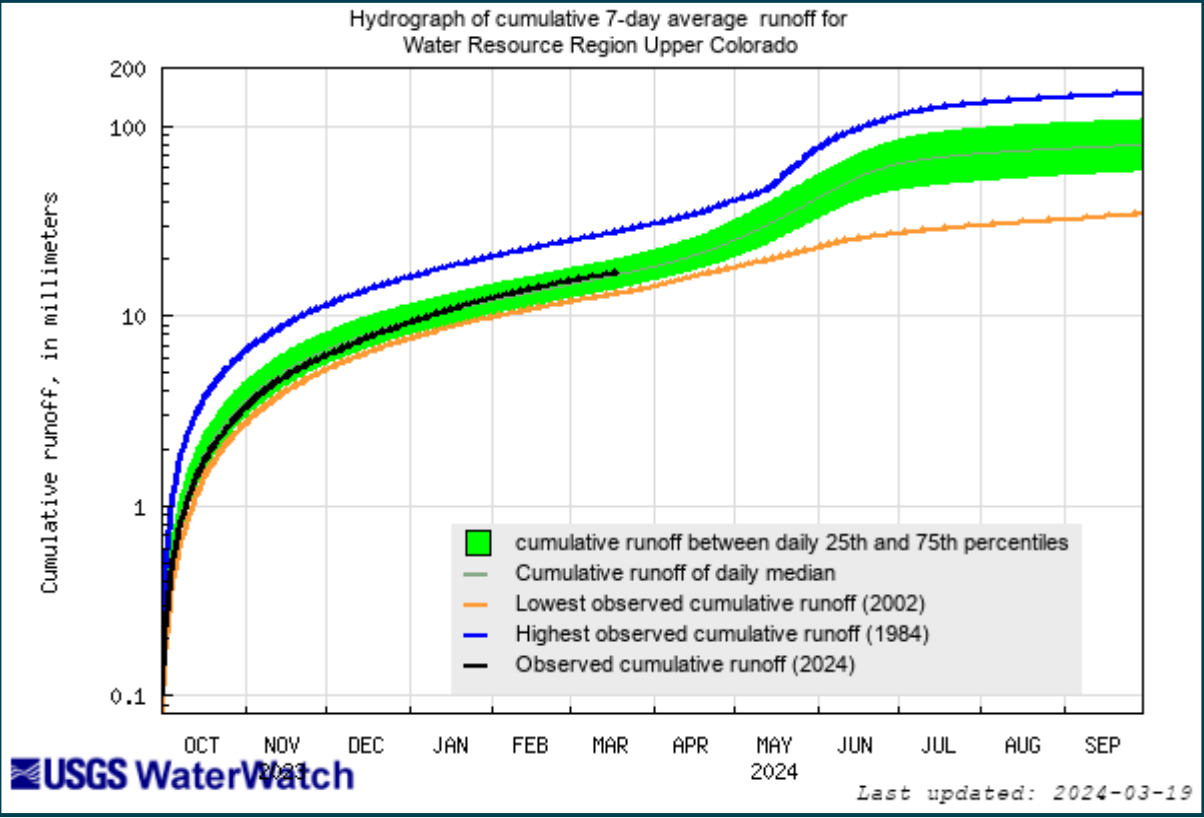


NOAA / Colorado Basin River Forecast Center / 2020-07-30 14:21Z



Upper Colorado Observed Inflows

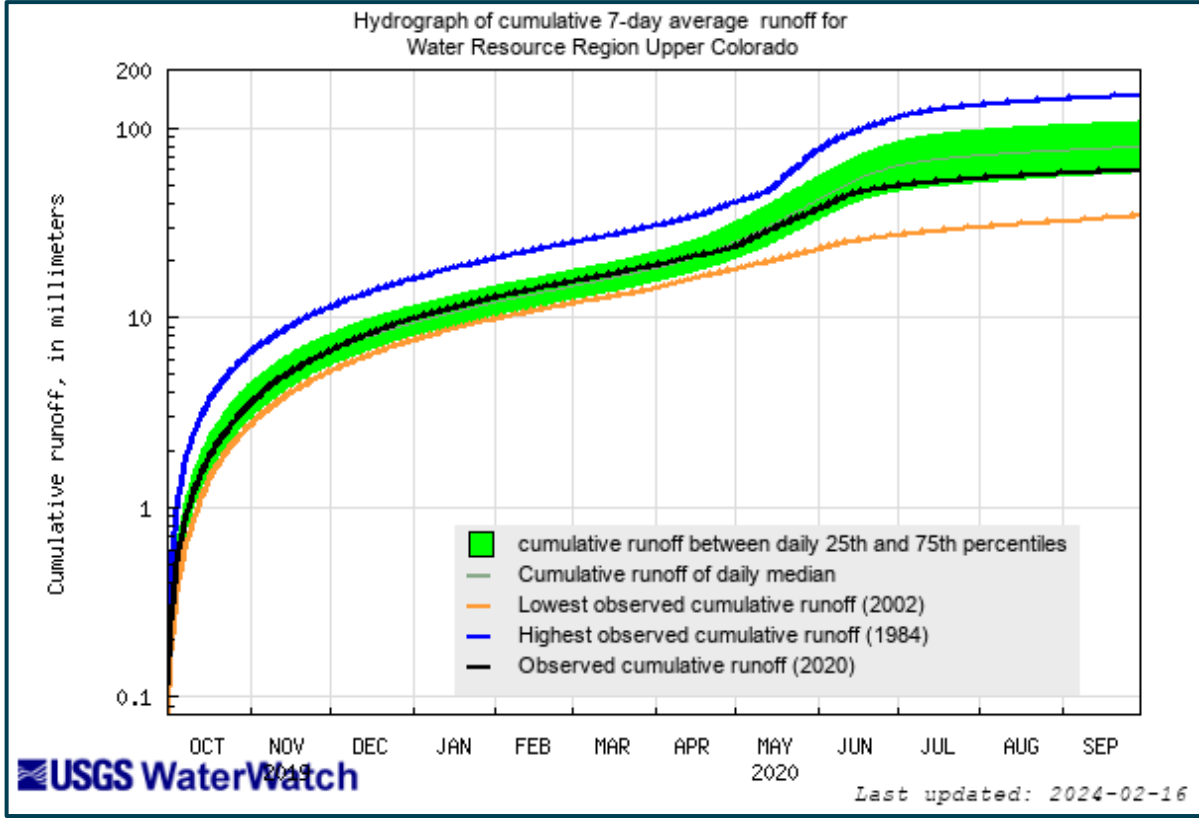
Mar Midmonth WY2024 = 8.08 maf (84% of avg)



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

Observed WY2020 = 5.85 maf (61% of avg)

Mar Midmonth WY2020 = 8.30 maf (86% of avg)*



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

*WY2020 averages are based on the 1991 through 2020 period of record. The March 2020 percent of average based on the 1981 through 2010 period of record is 77% of average.



Most Probable March Forecast Water Year 2024

April – July 2024
Forecasted Unregulated Inflow
as of March 5, 2024

Reservoir	Inflow (kaf)	Change from Feb	Percent of Avg ¹	MM Percent of Avg
Fontenelle	585	+45	80	82
Flaming Gorge	780	+100	81	88
Blue Mesa	560		88	91
Navajo	390		62	73
Powell	5,000	+300	78	85

March Midmonth = 5,400 kaf +400 (85%)

Water Year 2024
Unregulated Inflow Forecast
as of March 5, 2024

Reservoir	Inflow (kaf)	Change from Feb	Percent of Avg ¹
Fontenelle	919	+49	86
Flaming Gorge	1,263	+115	90
Blue Mesa	801	+2	88
Navajo	548	-5	60
Powell	7,656	+300	80

March Midmonth = 8,076 kaf +430 (84%)

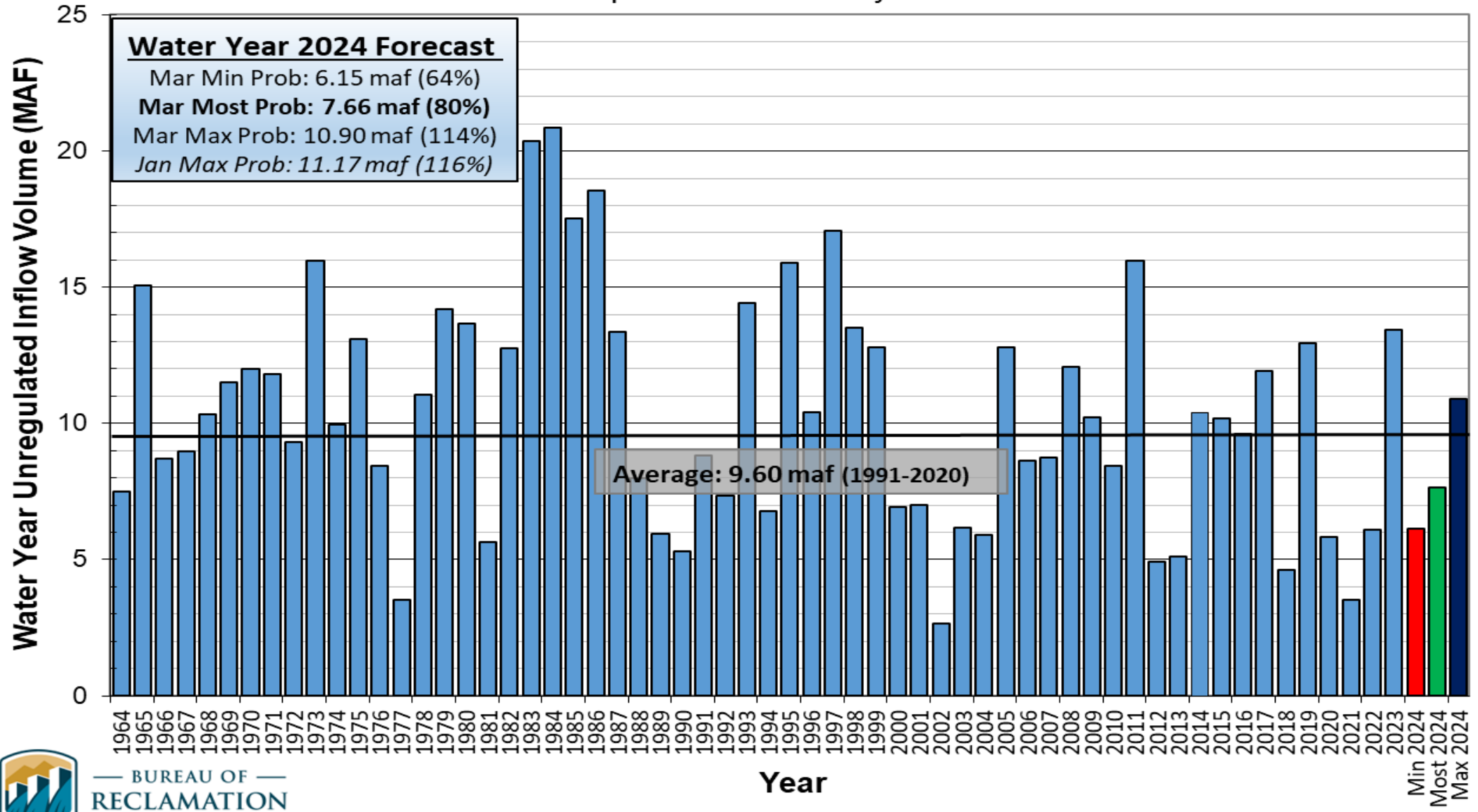
¹Averages are based on the 1991 through 2020 period of record.



Lake Powell Unregulated Inflow

Water Year 2024 Forecast (issued March 5)

Comparison with History



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Upper Colorado Basin

Hydrology and Operations
Projections Based on January
and March 2024 24-Month
Study



Upper Basin Reservoir Operations

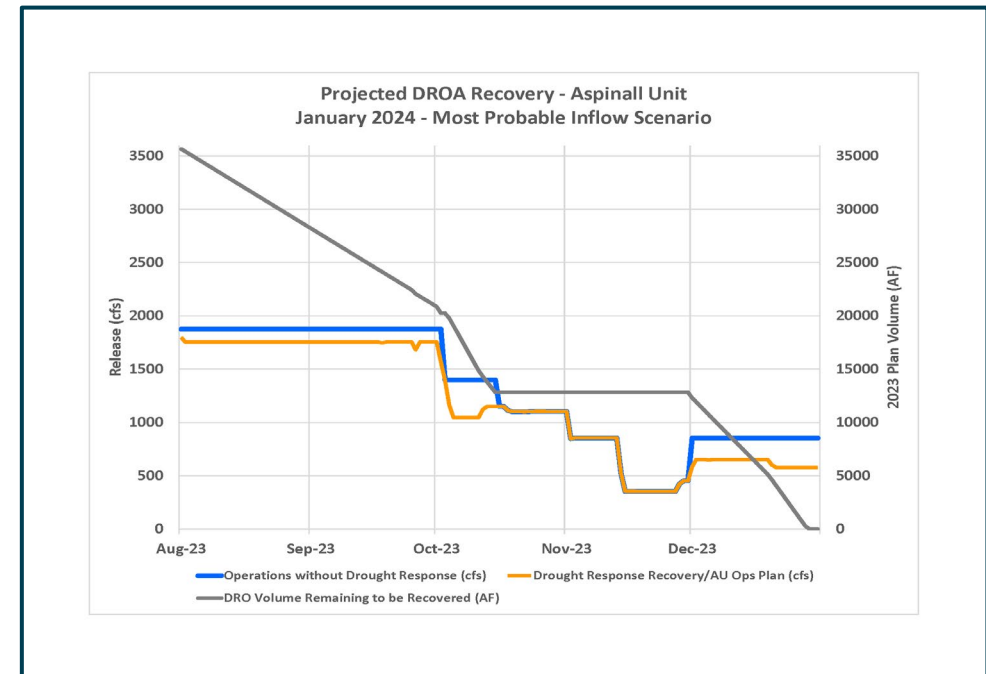
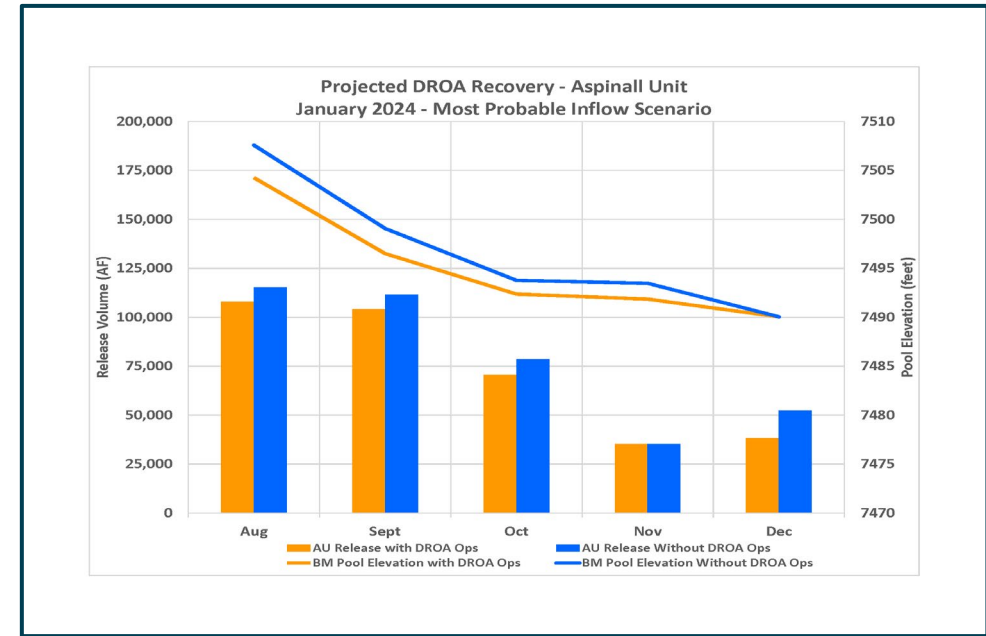
Water Years 2024 and 2025

- 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.



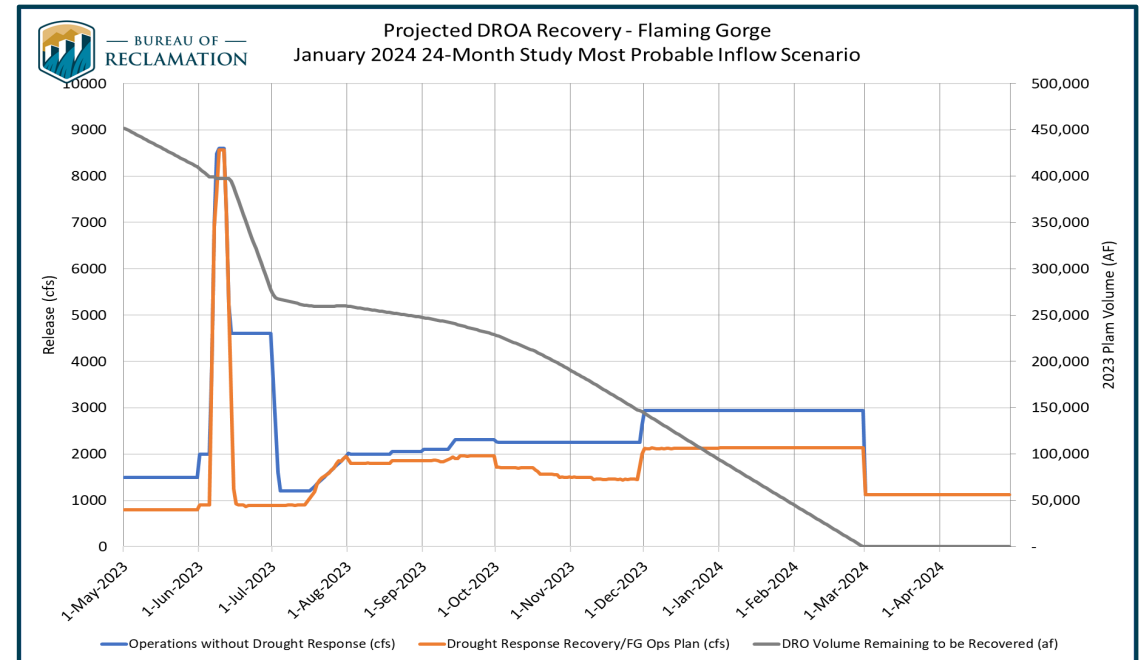
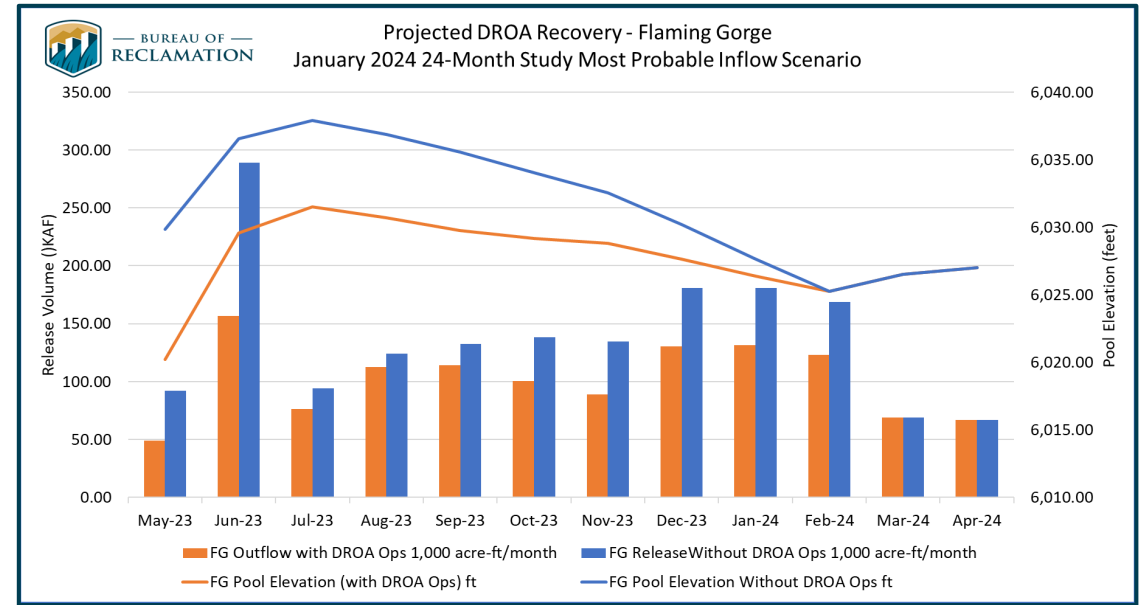
DROA Recovery - BM

- Total DROA release - 36 kaf
- Incremental recovery achieved end of day 12/29/23.
- Icing target achieved at 7490.05' on midnight 12/31/23.



DROA Recovery - FG

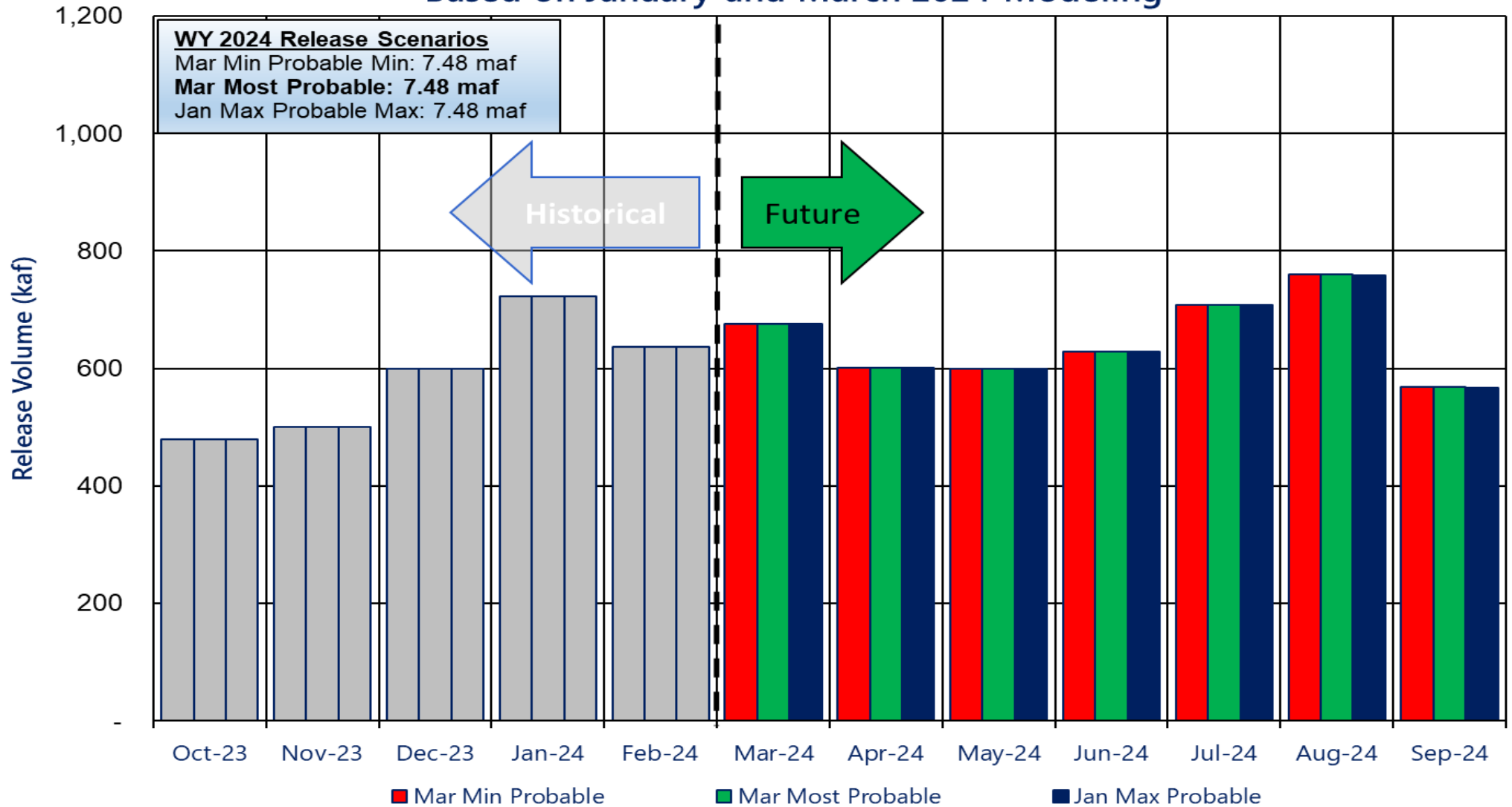
- Total DROA release - 588 kaf
- Incremental recovery achieved end of day 2/28/24
- Per ROD, Reclamation's goal is to achieve the May 1 Drawdown Target of 6,027 feet (mod-dry target)



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2024

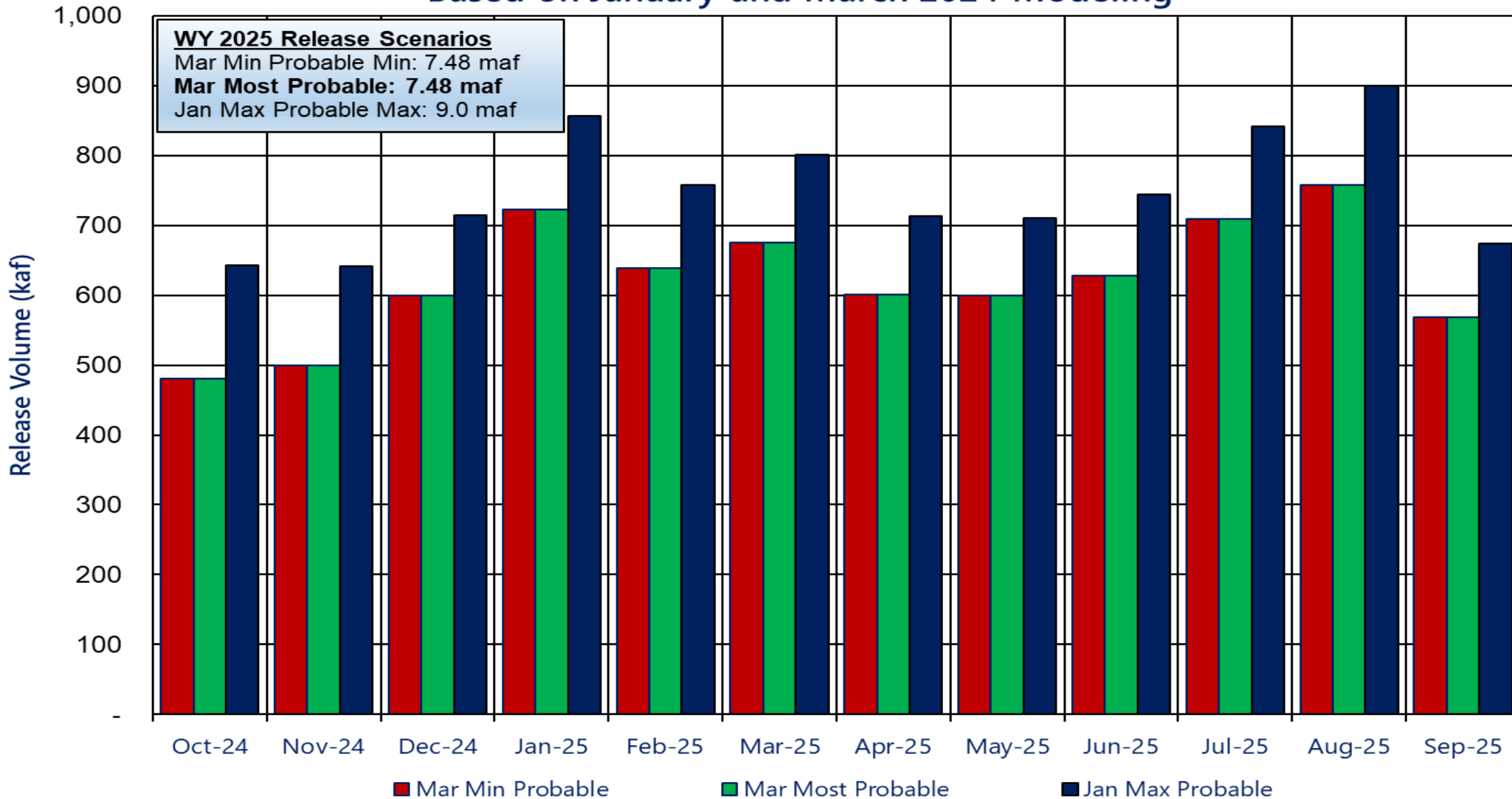
Based on January and March 2024 Modeling



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2025

Based on January and March 2024 Modeling



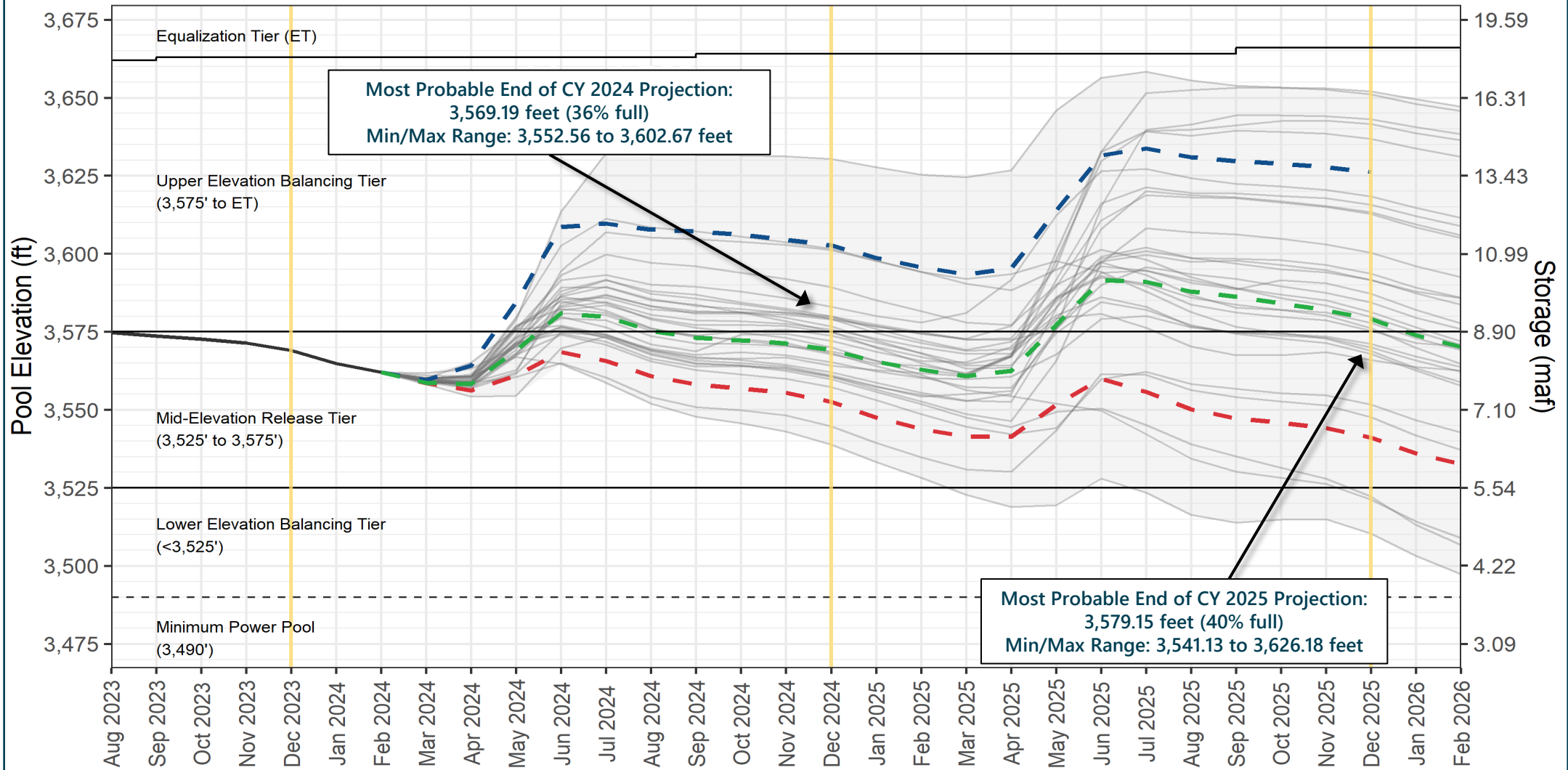
Reclamation Operational Modeling Model Comparison

	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

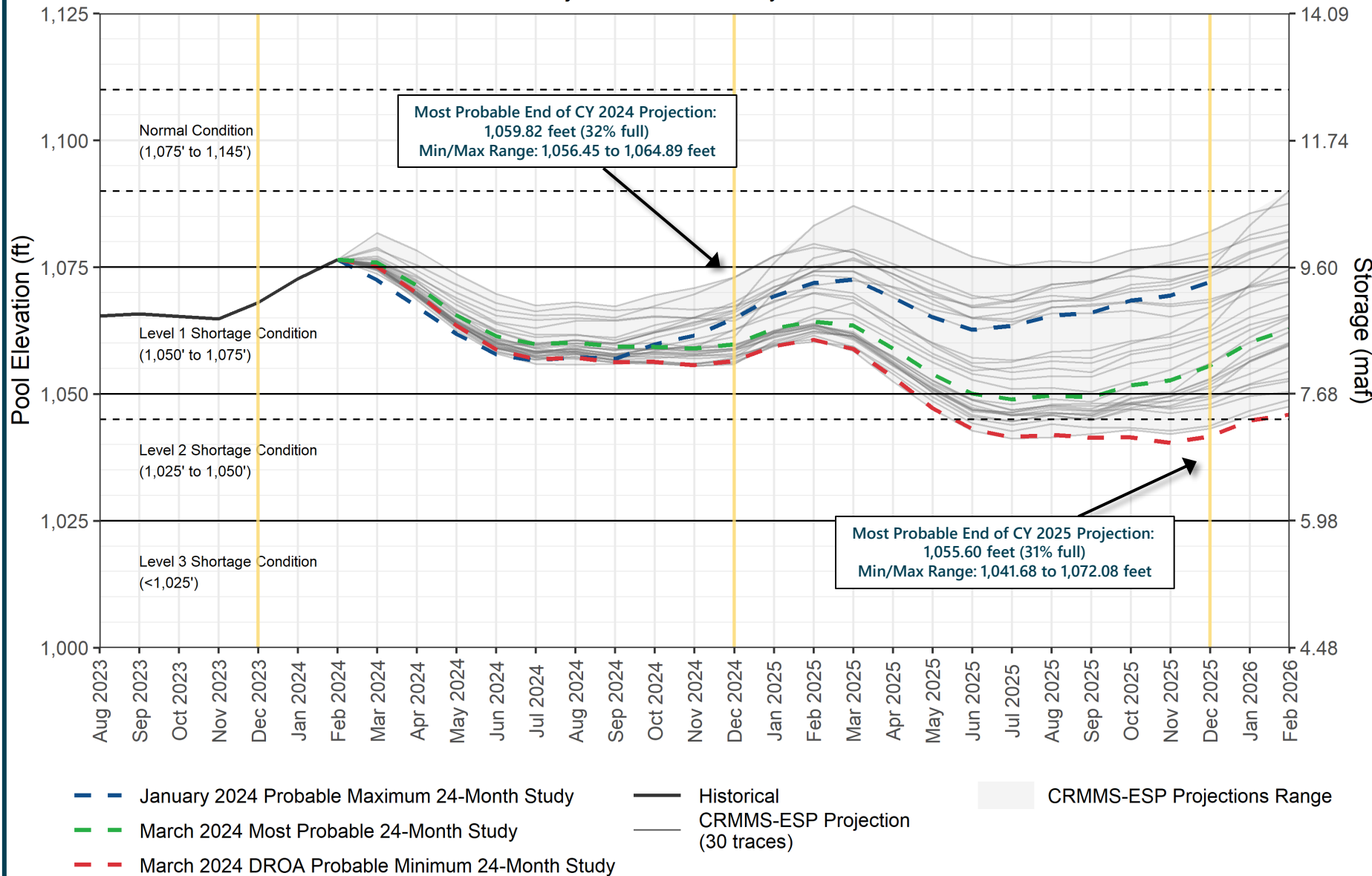
CRMMS Projections from January and March 2024



- January 2024 Probable Maximum 24-Month Study
- March 2024 Most Probable 24-Month Study
- March 2024 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 January and March 2024





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	█							█			█	
2	█											
3	█											
4	█											
5								█				
6								█				
7						█						
8						█						
Units Available	4	4	6	6	6	6	6	5	7	7	7	8
Capacity (cfs)	12,400	19,450	19,400	19,300	19,200	19,100	19,100	15,800	23,350	23,300	23,200	26,700
Capacity (kaf/month)	770	1,030	1,190	1,190	1,100	1,220	1,180	1,110	1,290	1,630	1,560	1,590
Max (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	567
Most (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	567
Min (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	567
										(updated 03-19-2024)		

MAR MOST²

MAR MOST

7.48 maf

7.48 maf

7.48 maf

1 Projected release, based on March 2024 24MS for the minimum and most probable and the January 2024 24MS for the maximum probable 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 Power Plant Unit Outage Schedule for 2025

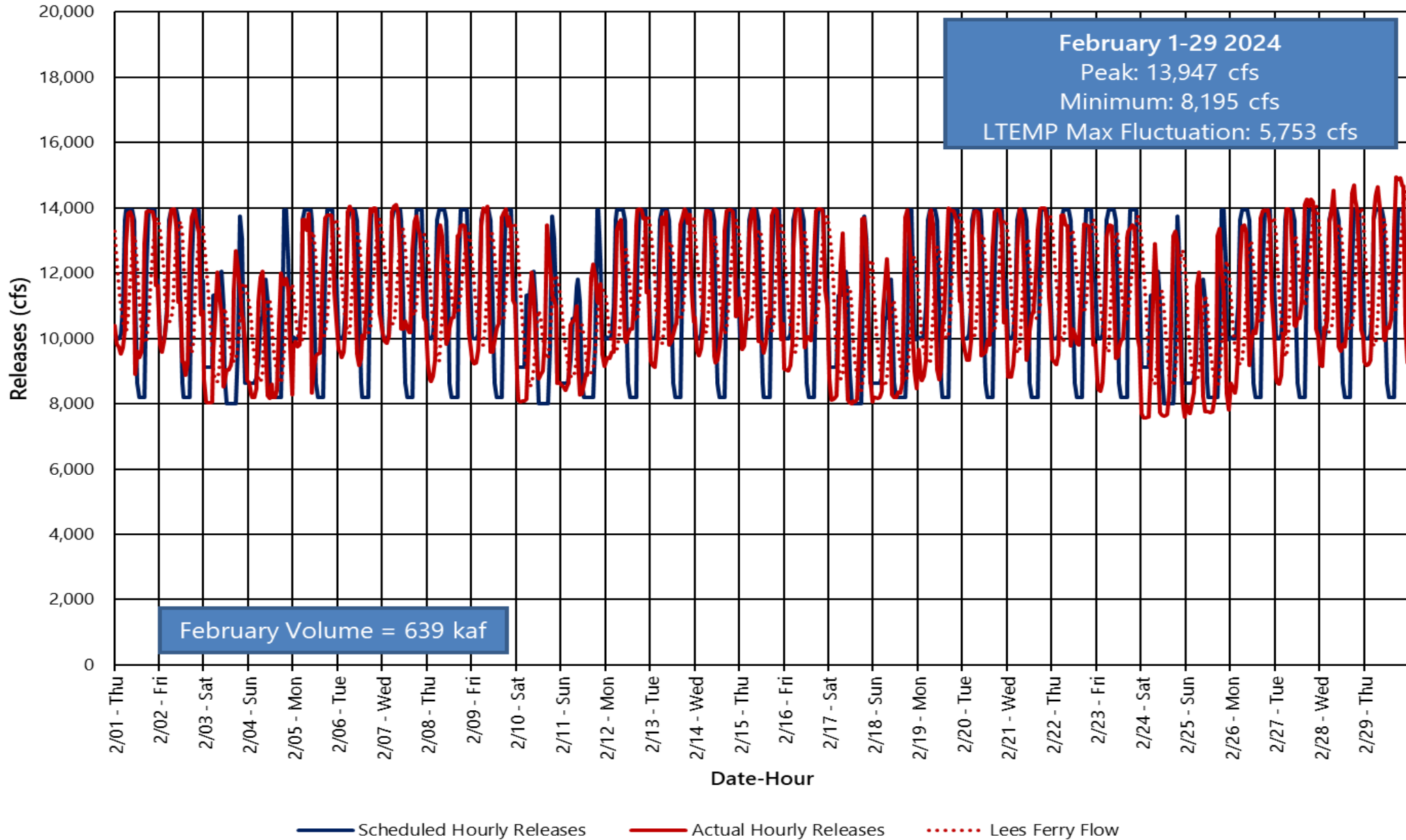
Unit Number	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025	Jul 2025	Aug 2025	Sep 2025	
1	■	■											
2		■					■						
3				■									
4				■									
5									■				
6									■				
7						■							
8						■							
Units Available	6	6	6	6	6	6	6	7	6	6	8	8	
Capacity (cfs)	19,500/ 4,000	19,500	19,500	19,500	19,500	19,500	19,500	23,100	19,500	19,500	26,700	26,700	MAR MOST ²
Capacity (kaf/month)	1,550	1,160	1,470	1,370	1,110	1,230	1,270	1,420	1,240	1,200	1,640	1,590	MAR MOST
Max (kaf) ¹	643	642	715	857	758	801	713	710	745	842	900	674	9.00 maf
Most (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568	7.48 maf
Min (kaf) ¹	480	500	600	723	639	675	601	599	628	709	758	568	7.48 maf
													(updated 03-19-2024)

1 Projected release, based on March 2024 24MS for the minimum and most probable and the January 2024 24MS for the maximum probable 24-Month Study model runs.

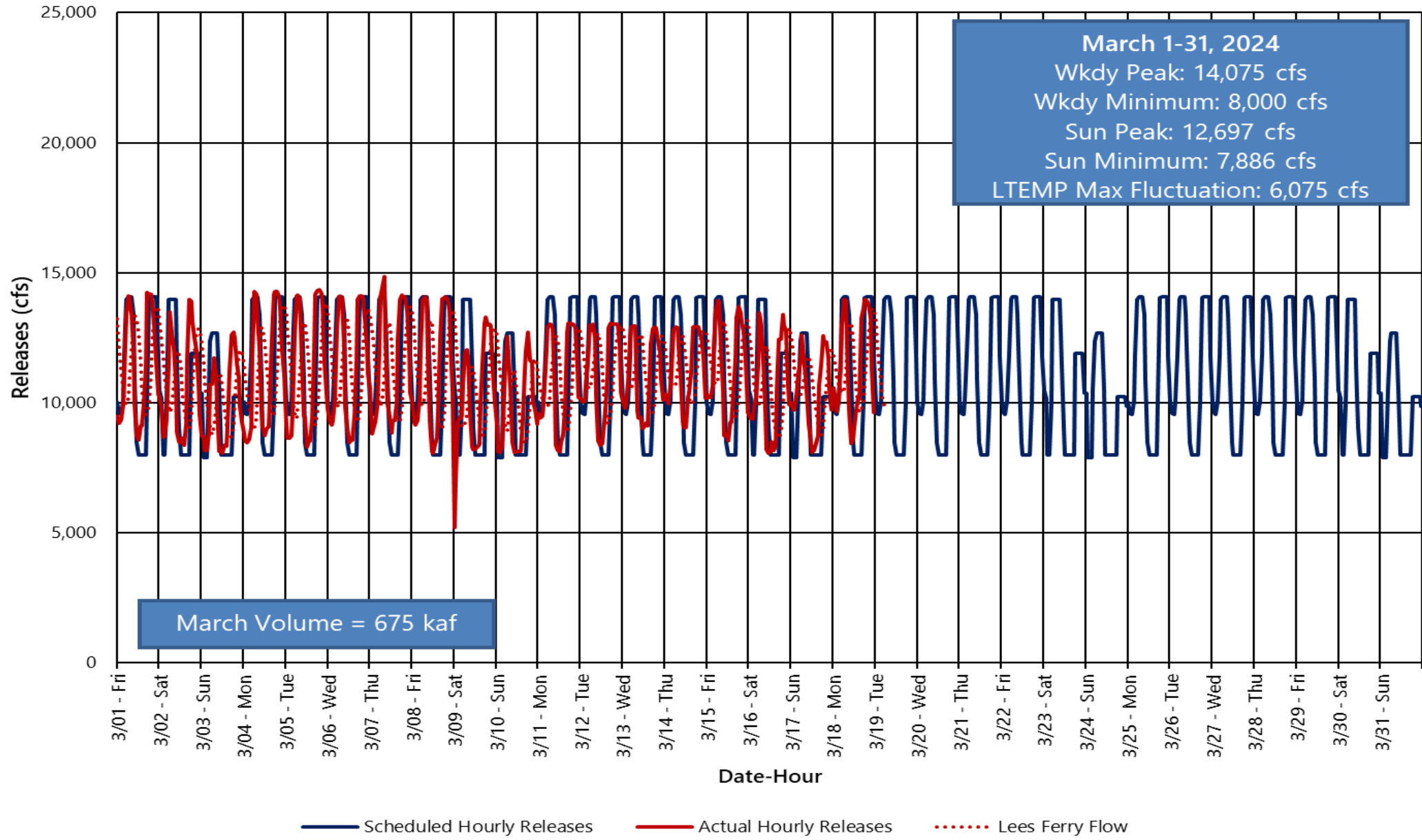
2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.



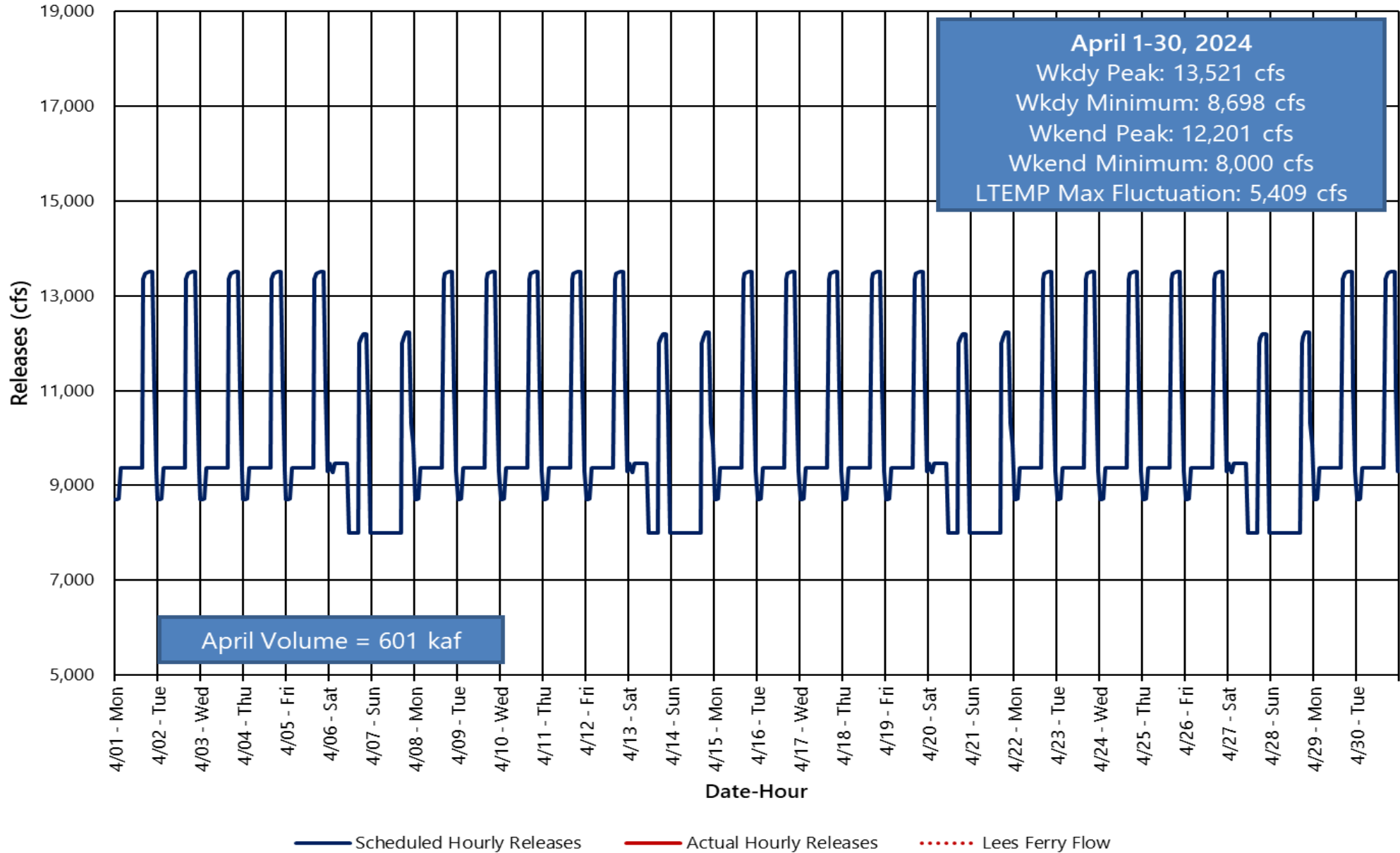
Glen Canyon Dam Hourly Release Pattern - February 2024



Glen Canyon Dam Hourly Release Pattern - March 2024



Glen Canyon Dam Hourly Release Pattern - April 2024

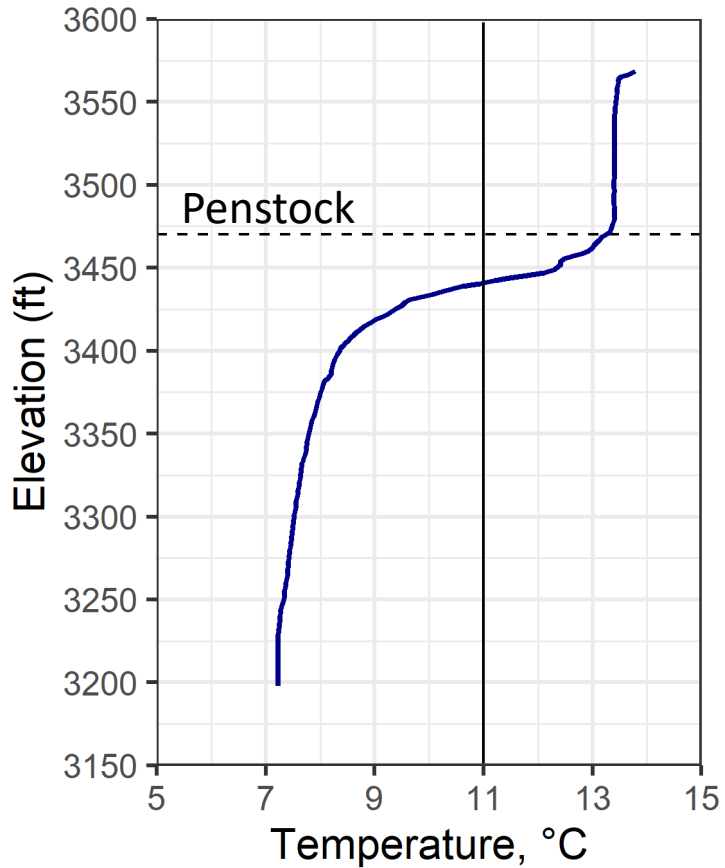


Water Quality

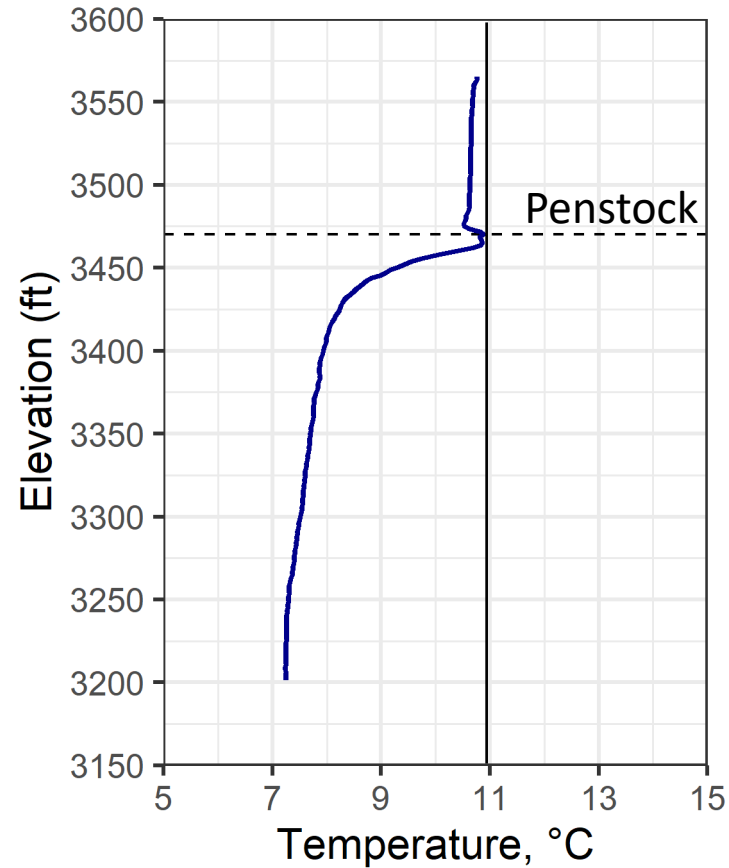


Observed Temp in Forebay near GCD

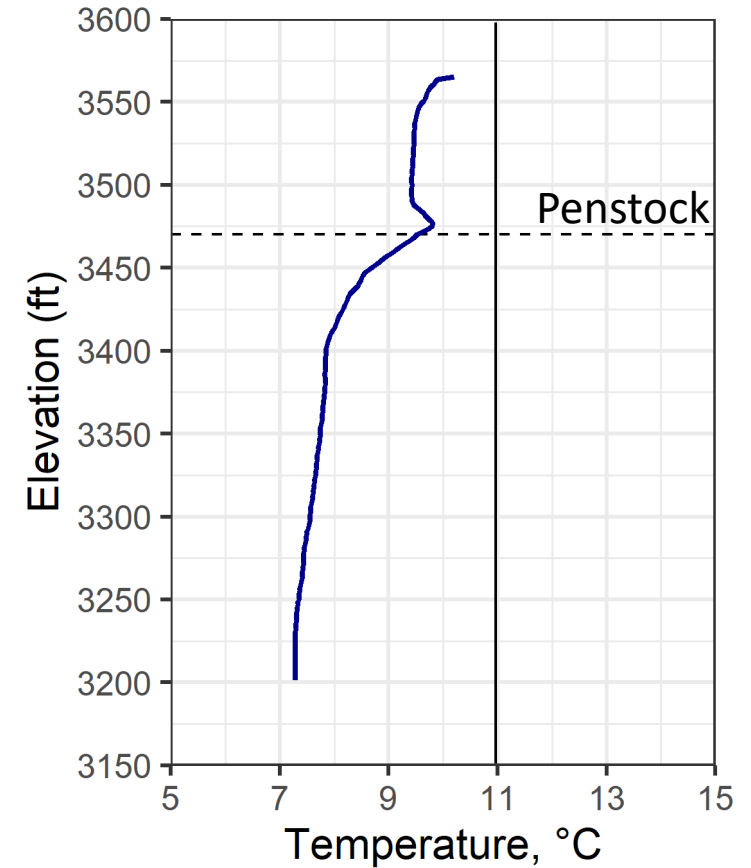
December 15, 2023



January 10, 2024



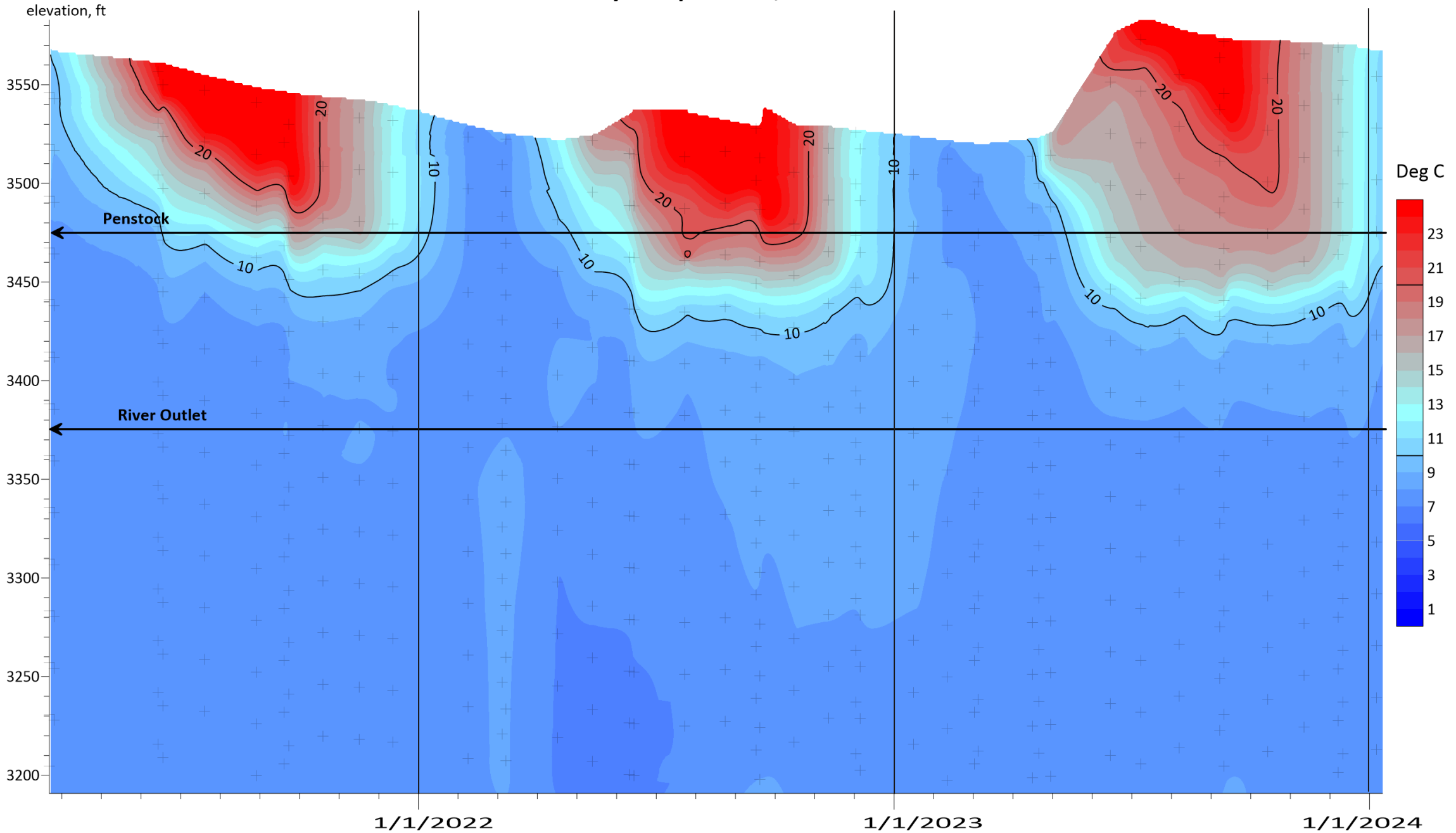
February 15, 2024



March profile sampling trip is this week.



Lake Powell Forebay Temperature, March 2021 - Jan 2024

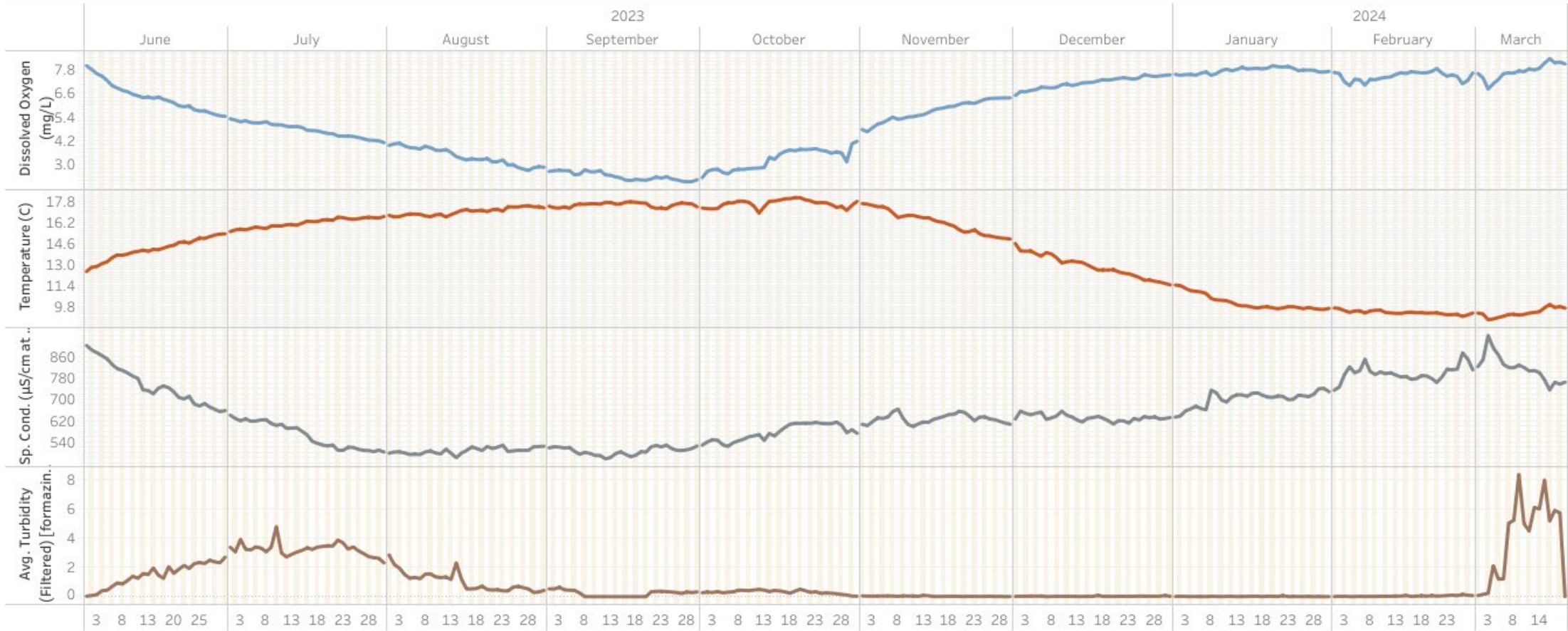


Glen Canyon Dam Site: Daily Averages

Select Date Range
All values

See Hourly Averages

Daily Average Dissolved Oxygen, Temperature, Specific Conductance, and Turbidity Values

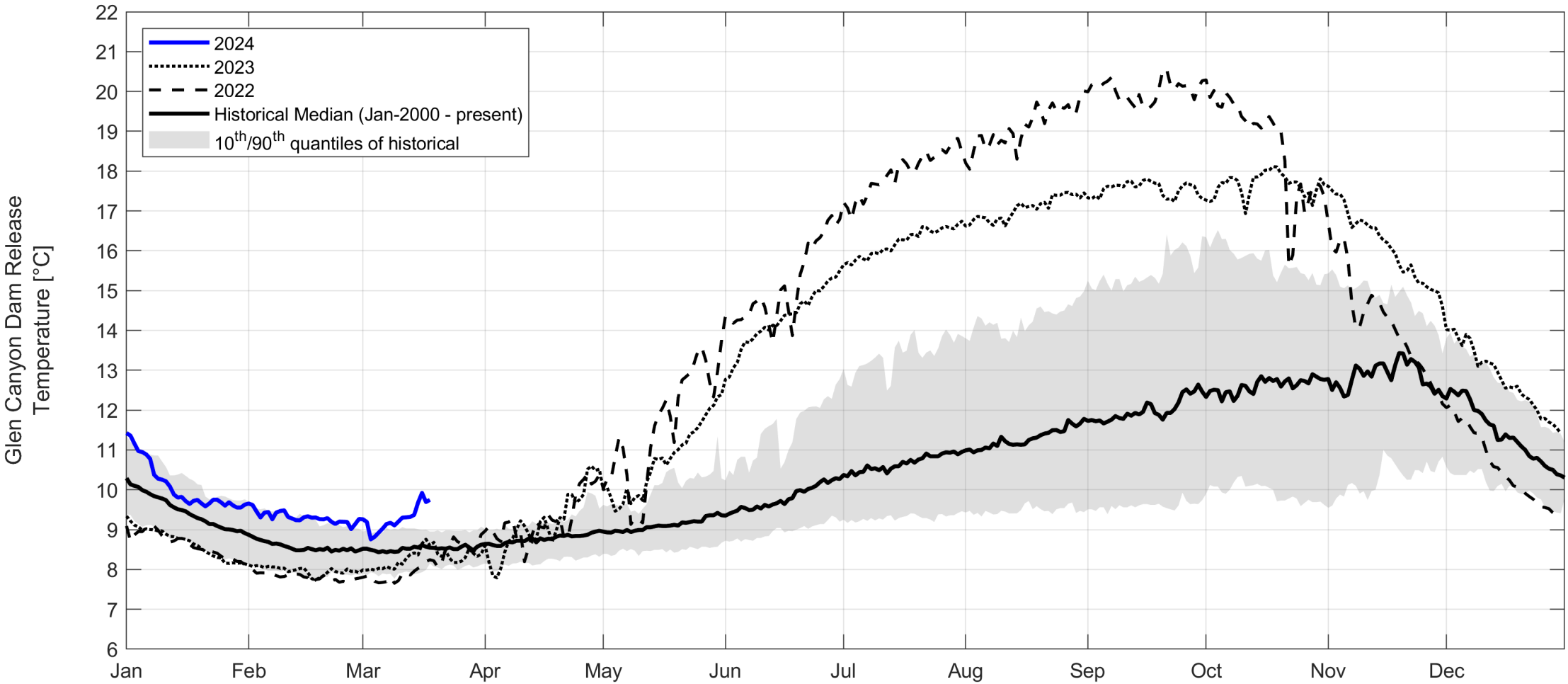


The water quality data shown here are filtered raw values and are subject to revision through quality control / quality assurance procedures. These data are being provided to meet the need for timely best science. The data have not received final approval by the U.S. Geological Survey (USGS) and are provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the data. **Please visit GCMRC's Discharge, Sediment and Water Quality web site to plot or download the processed measurements from this station:**

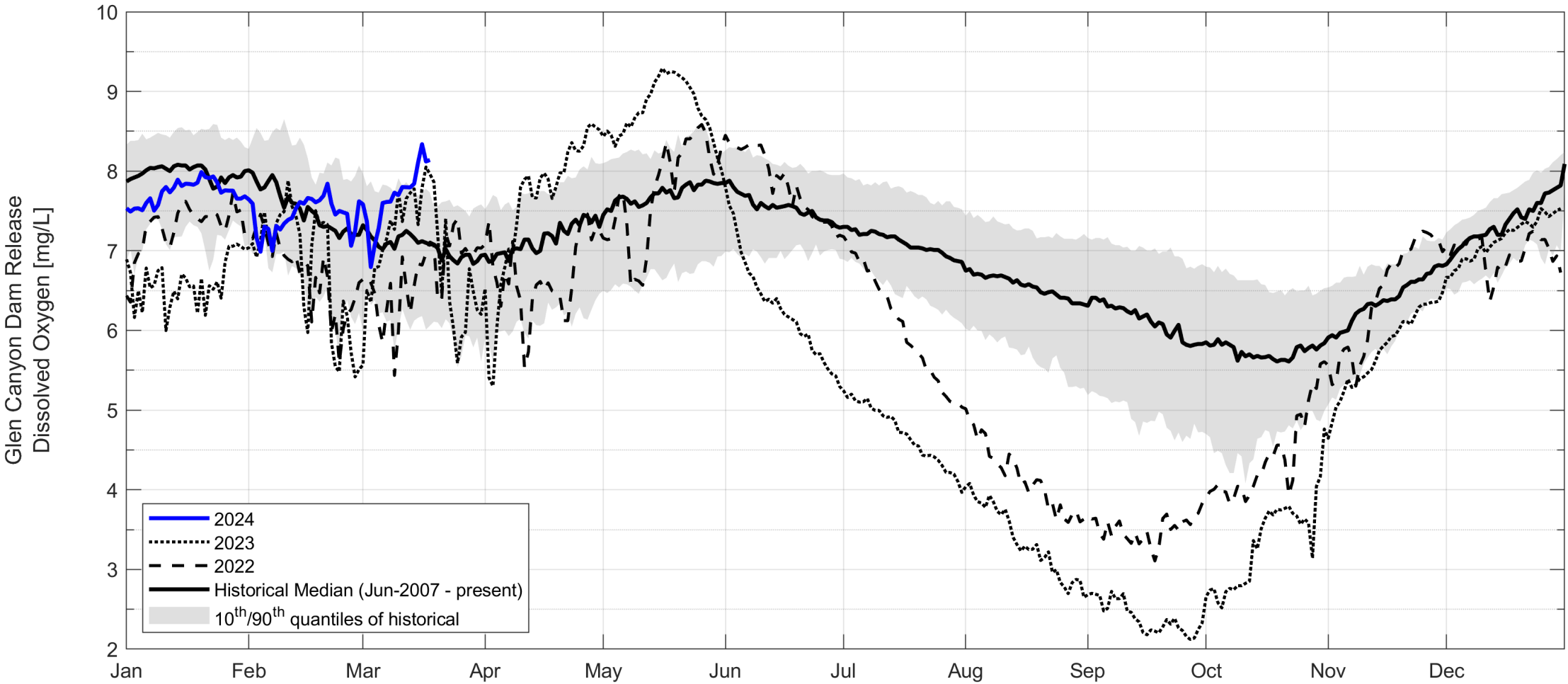
https://www.gcmrc.gov/discharge_qw_sediment/station/GCDAMP/09379901



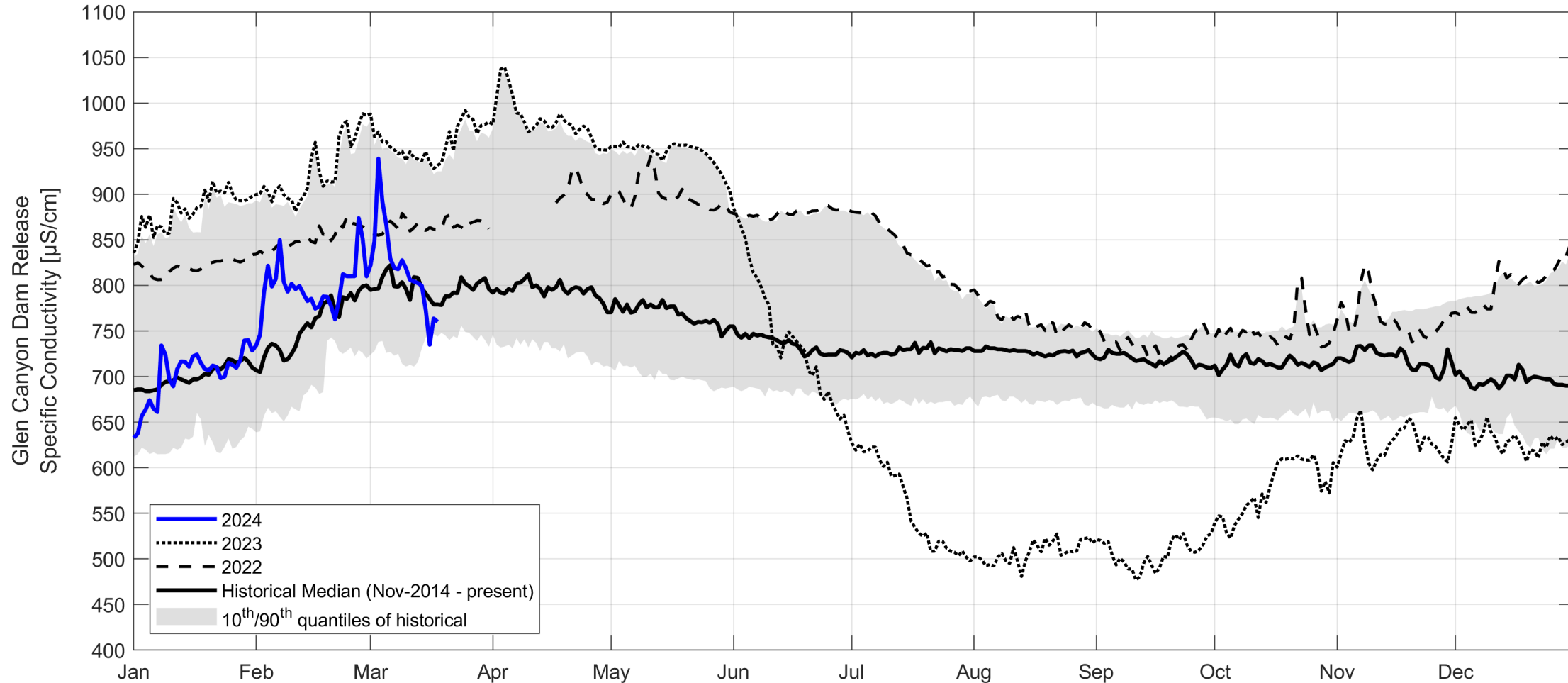
Glen Canyon Dam Observations - Temperature



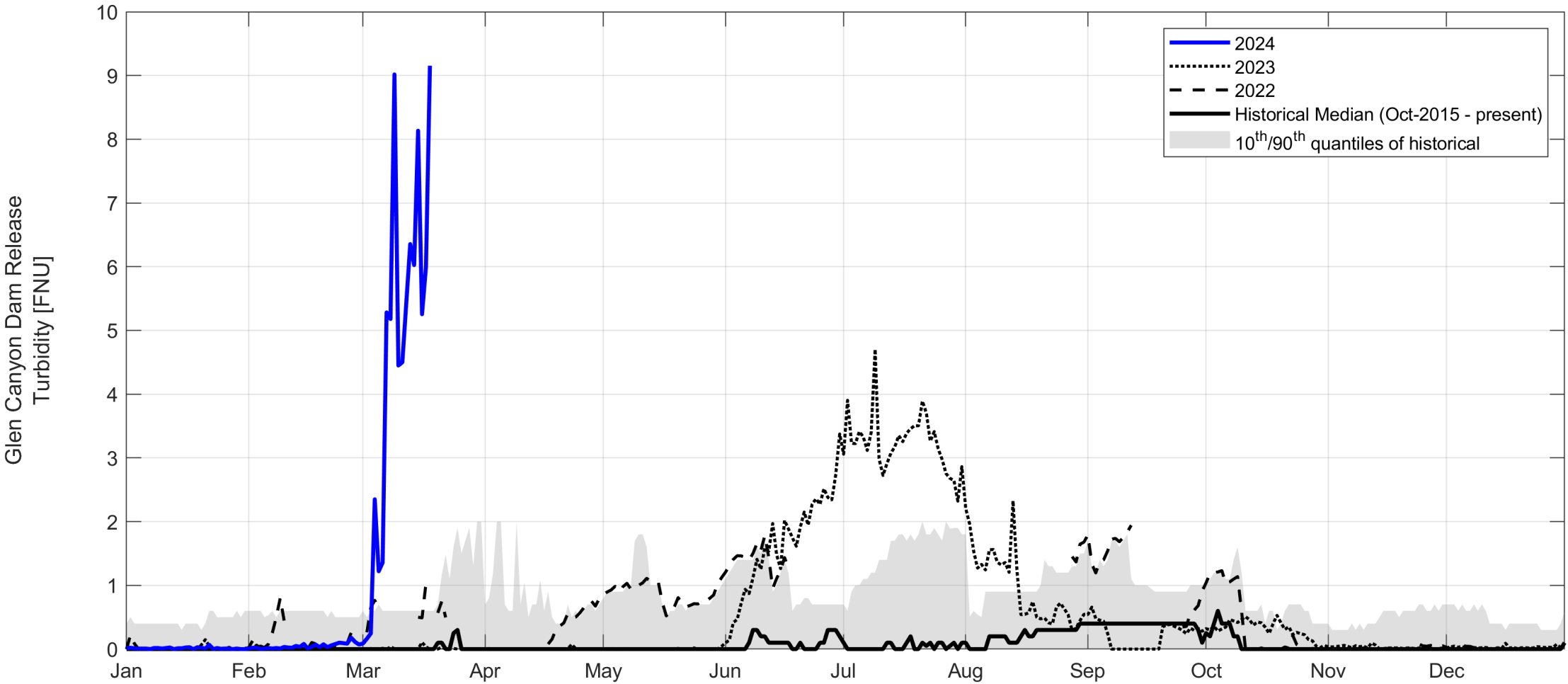
Glen Canyon Dam Observations – Dissolved Oxygen



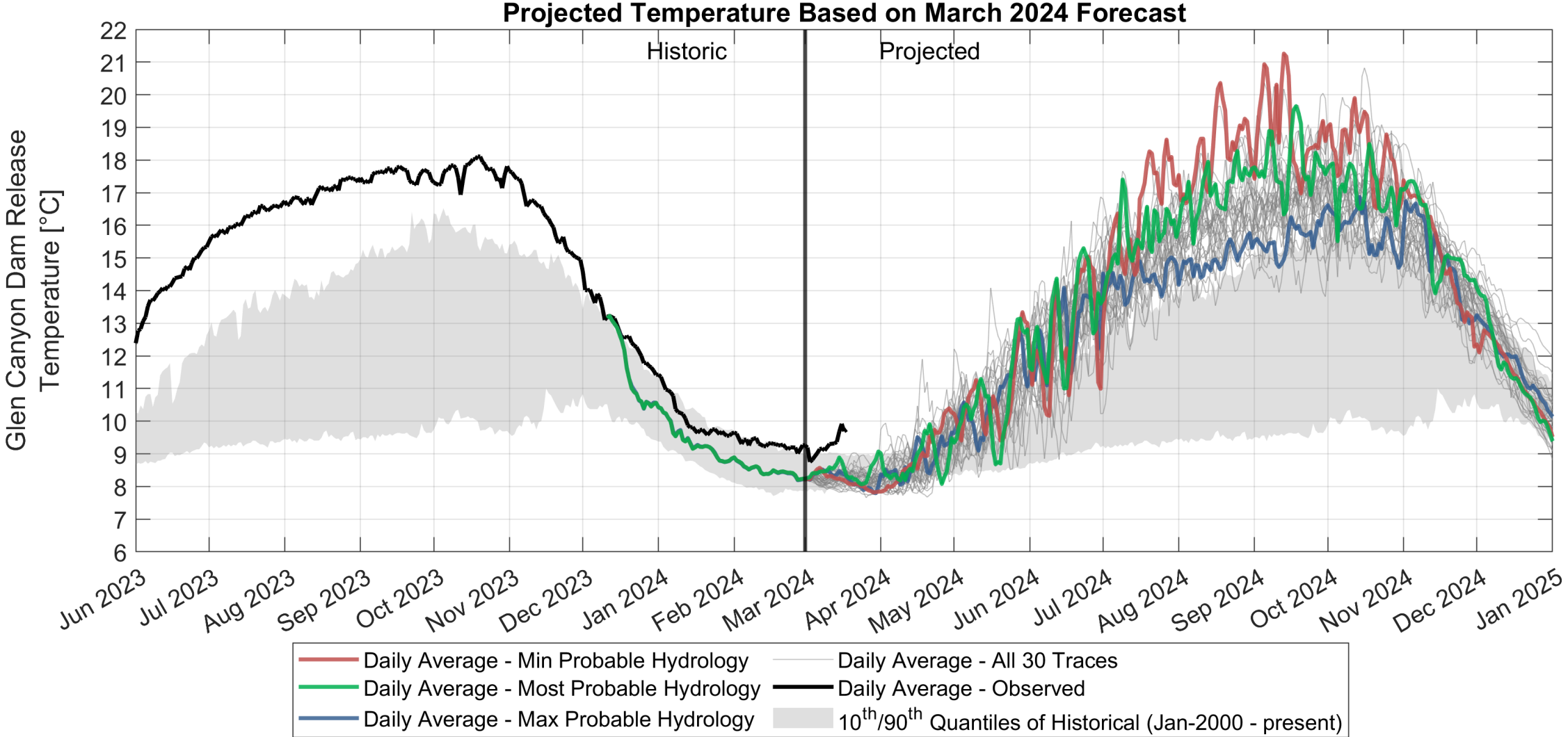
Glen Canyon Dam Observations – Specific Conductance



Glen Canyon Dam Observations - Turbidity

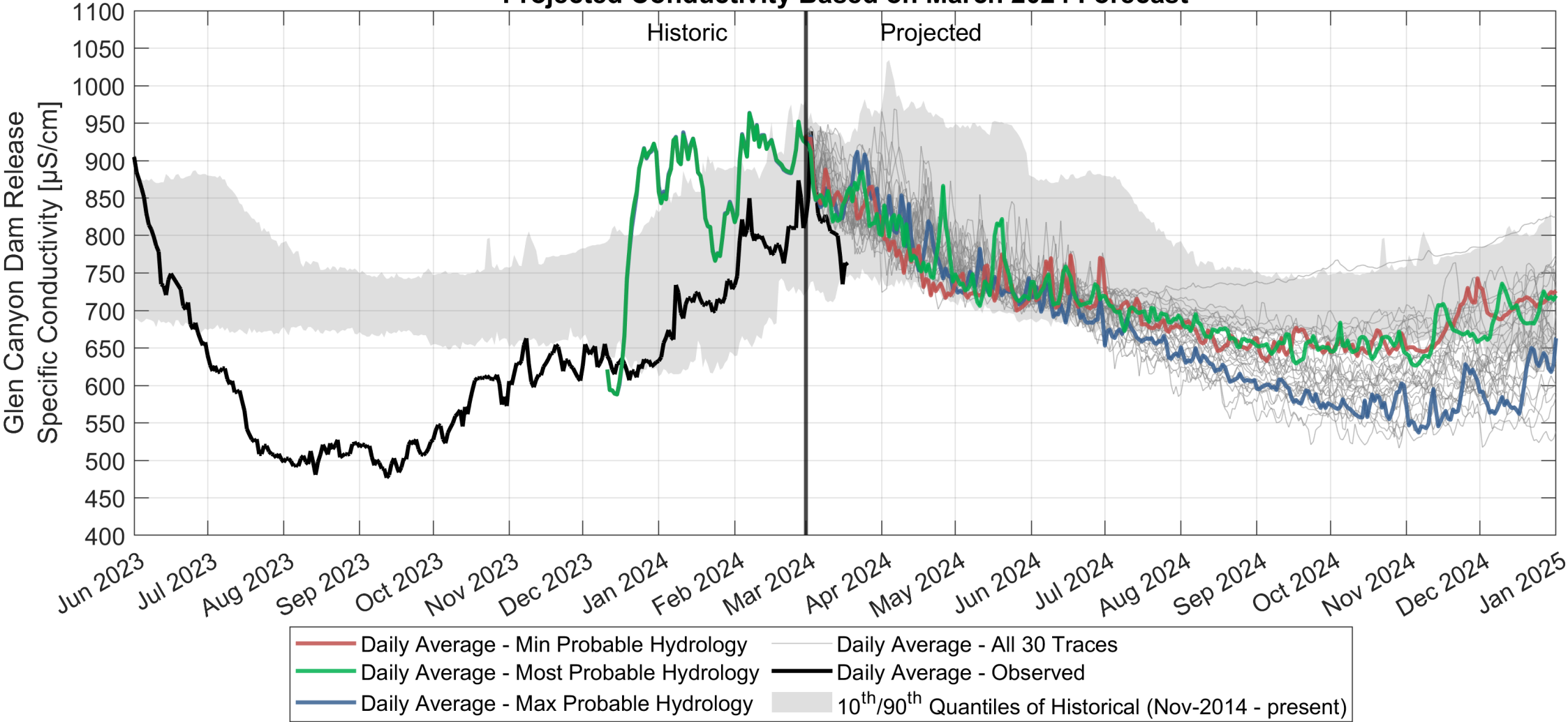


CE-QUAL-W2 Modeled Temperature



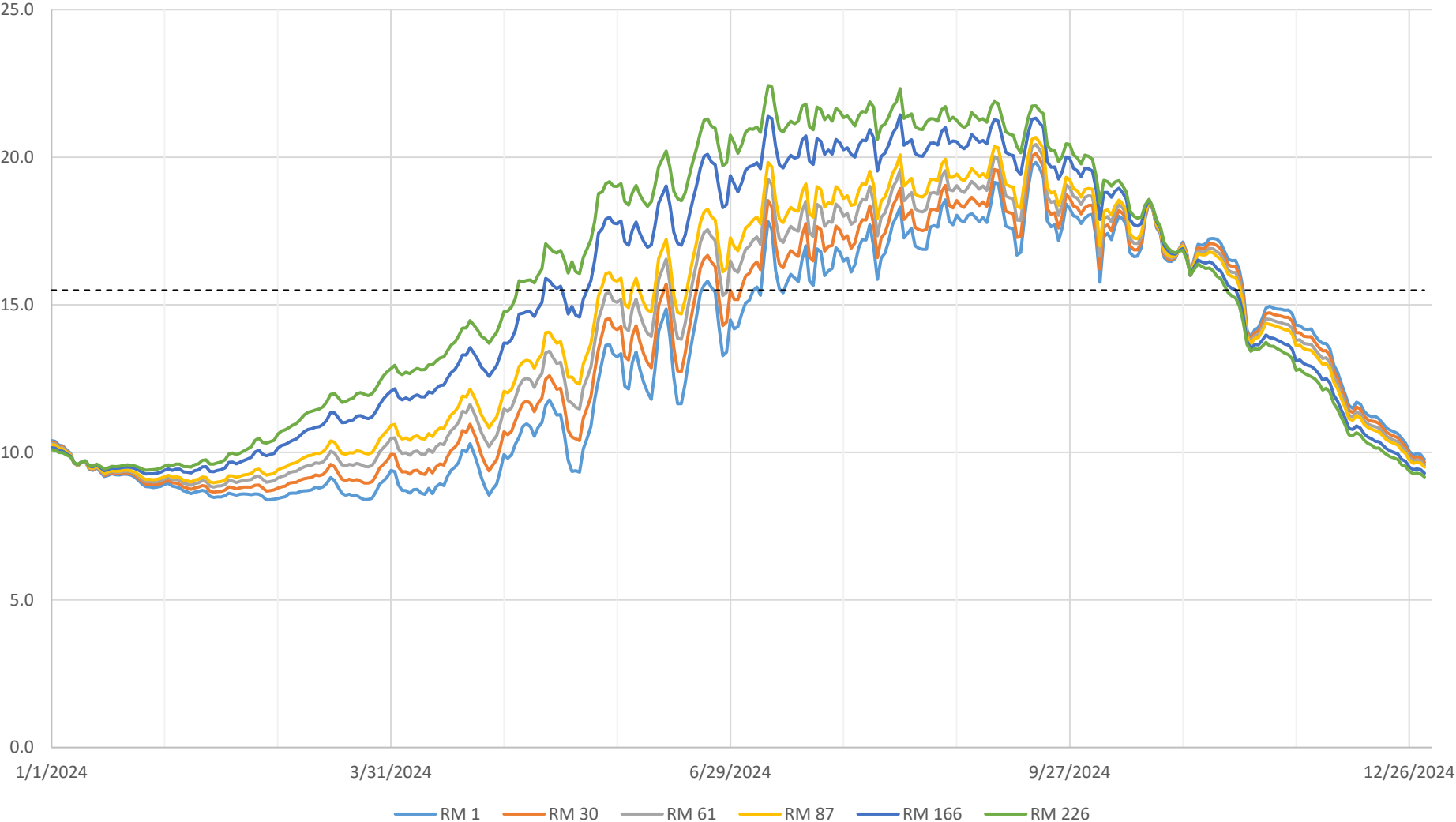
CE-QUAL-W2 Modeled Conductivity

Projected Conductivity Based on March 2024 Forecast



Dibble et al. Grand Canyon Modeled Temperature

March 2024 Most - Dibble et al. Grand Canyon Temperature Model Projections



Questions?



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