BUREAU OF RECLAMATION

Glen Canyon Monthly Operations Call

Basin Hydrology and Operations

July 17, 2024

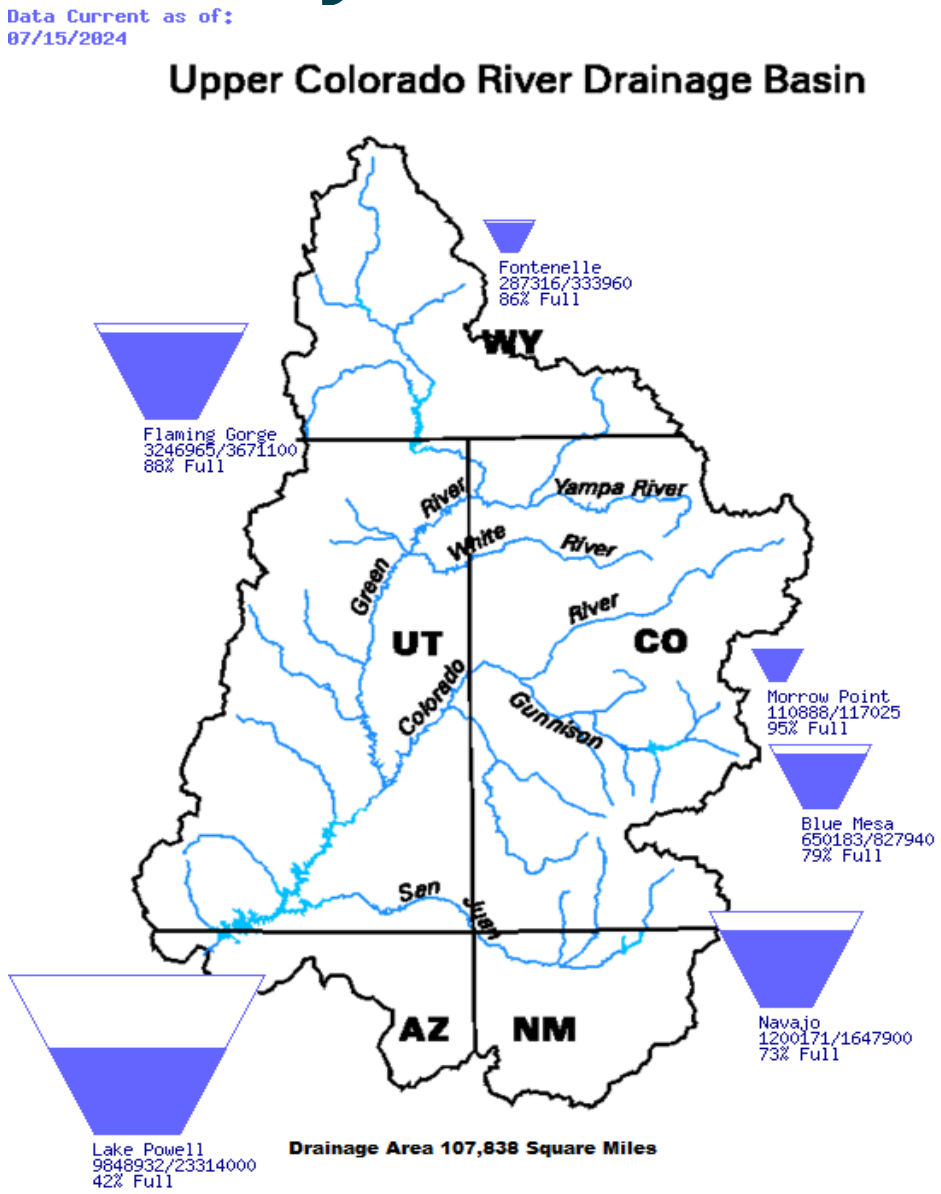
Background

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."

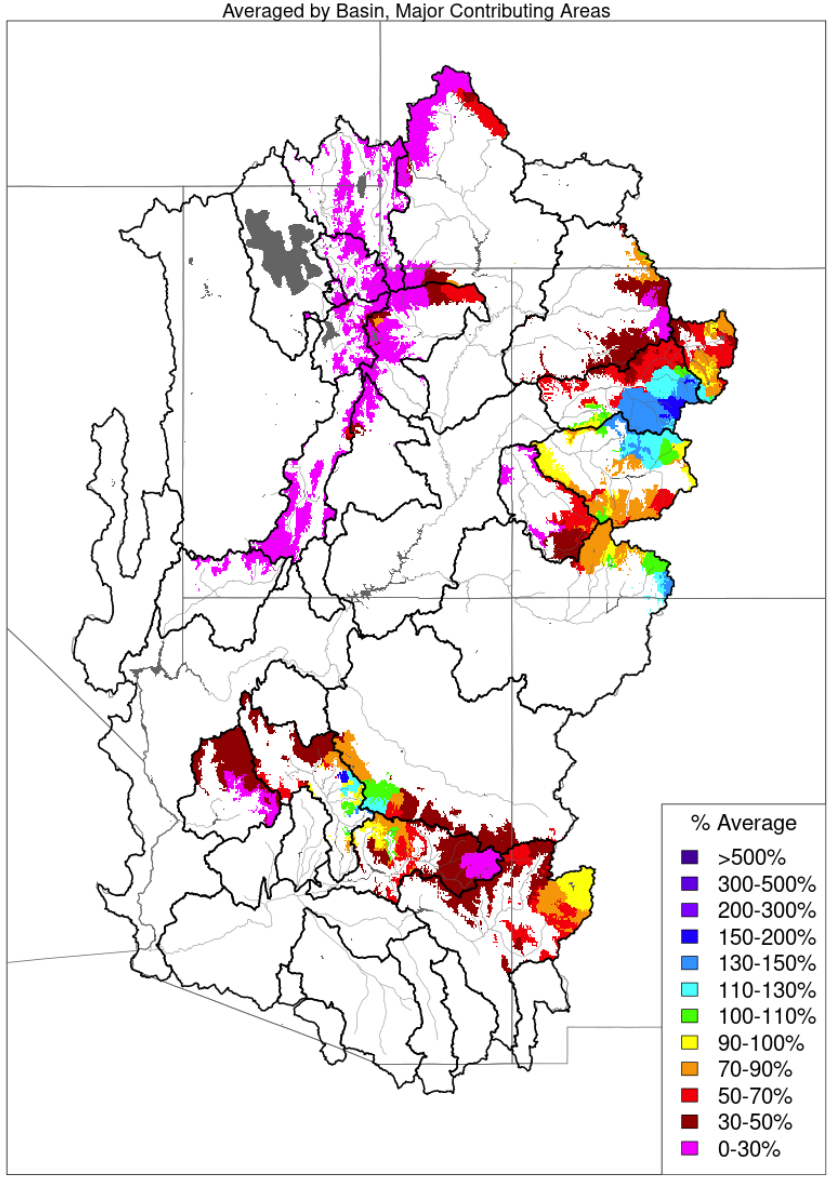
Upper Basin Storage (as of July 16, 2024)

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	86	0.29	0.33	6,499.86
Flaming Gorge	88	3.25	3.67	6,029.51
Blue Mesa	78	0.65	0.83	7,498.73
Navajo	73	1.20	1.65	6,050.48
Lake Powell	40	9.83	23.31	3,586.67
UC System Storage	51	15.35	29.79	
Total System Storage	45	26.21	58.48	



Month to Date Precipitation - July 17 2024

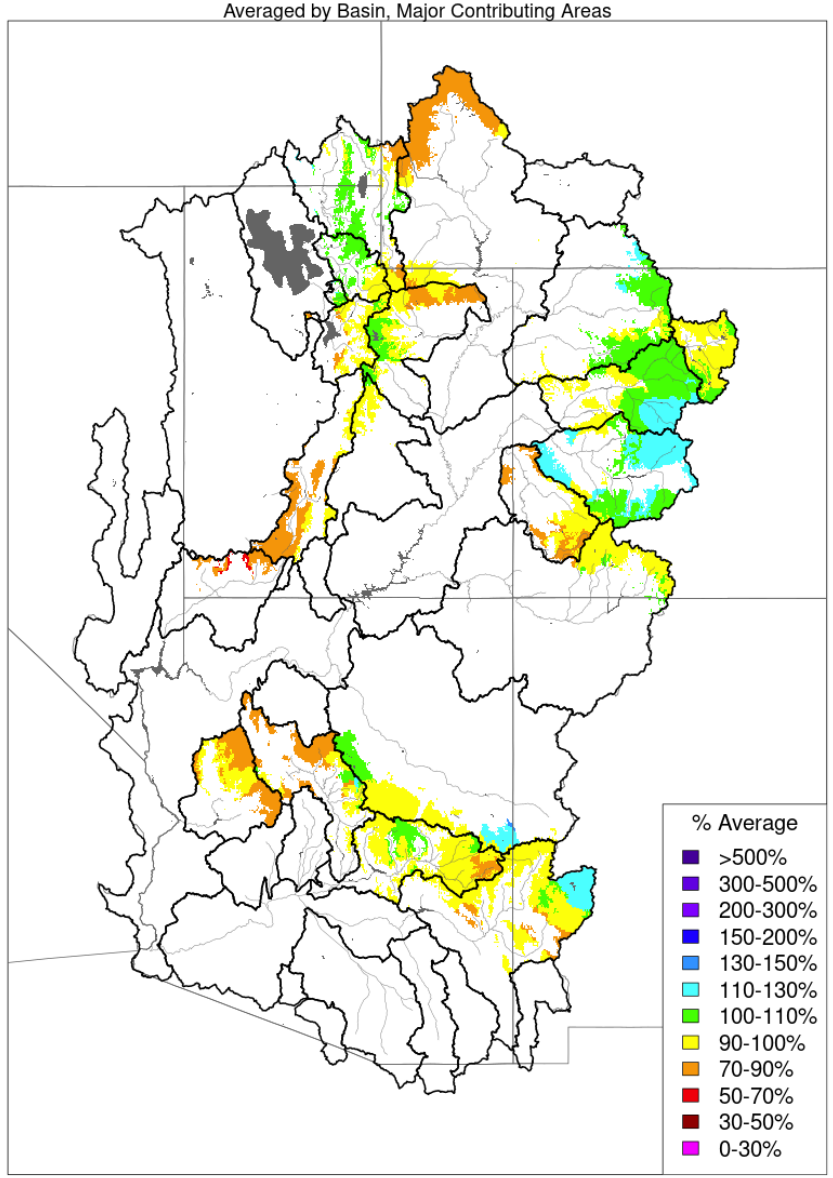
Averaged by Basin, Major Contributing Areas



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

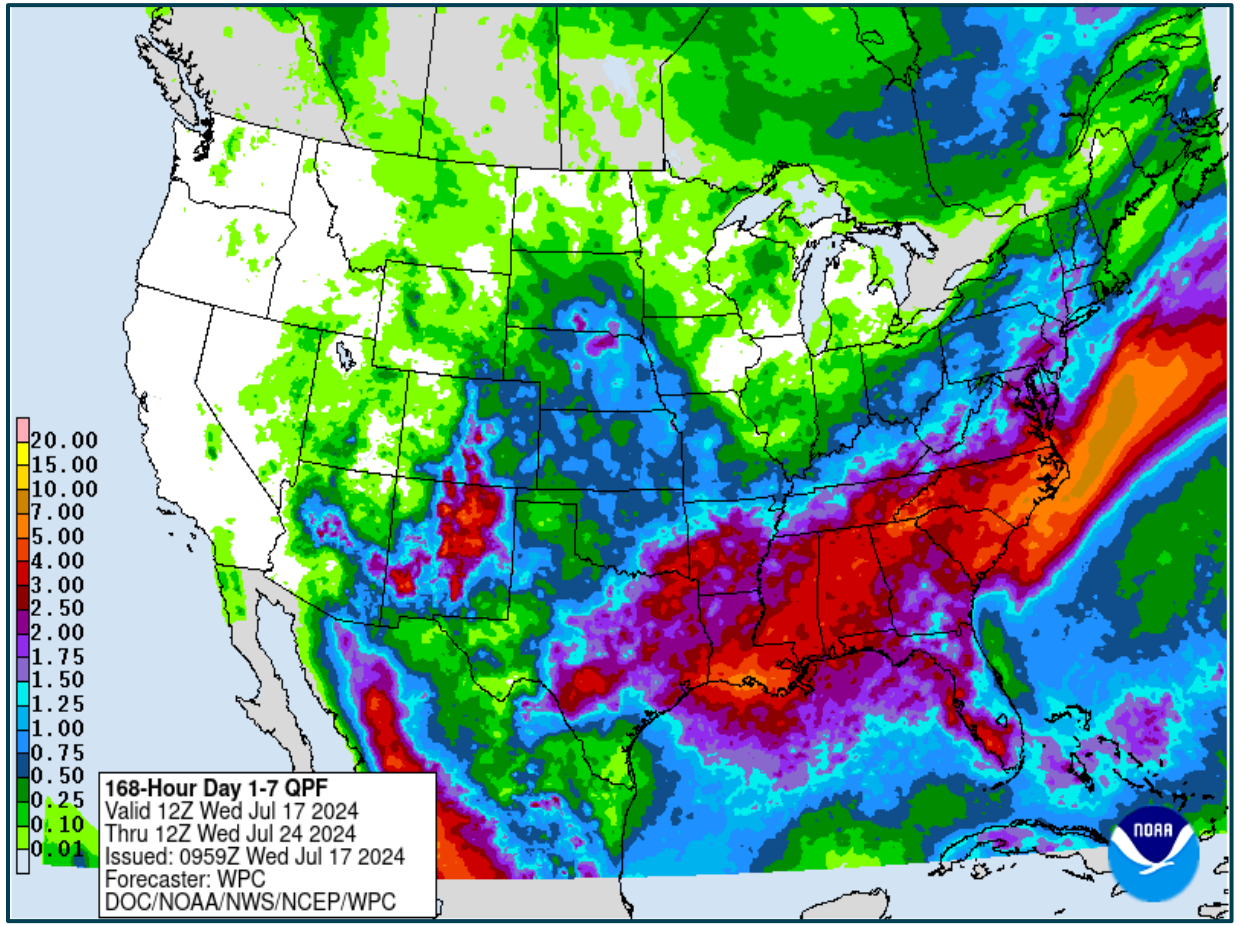
Water Year to Date Precipitation, October 01 - July 17 2024

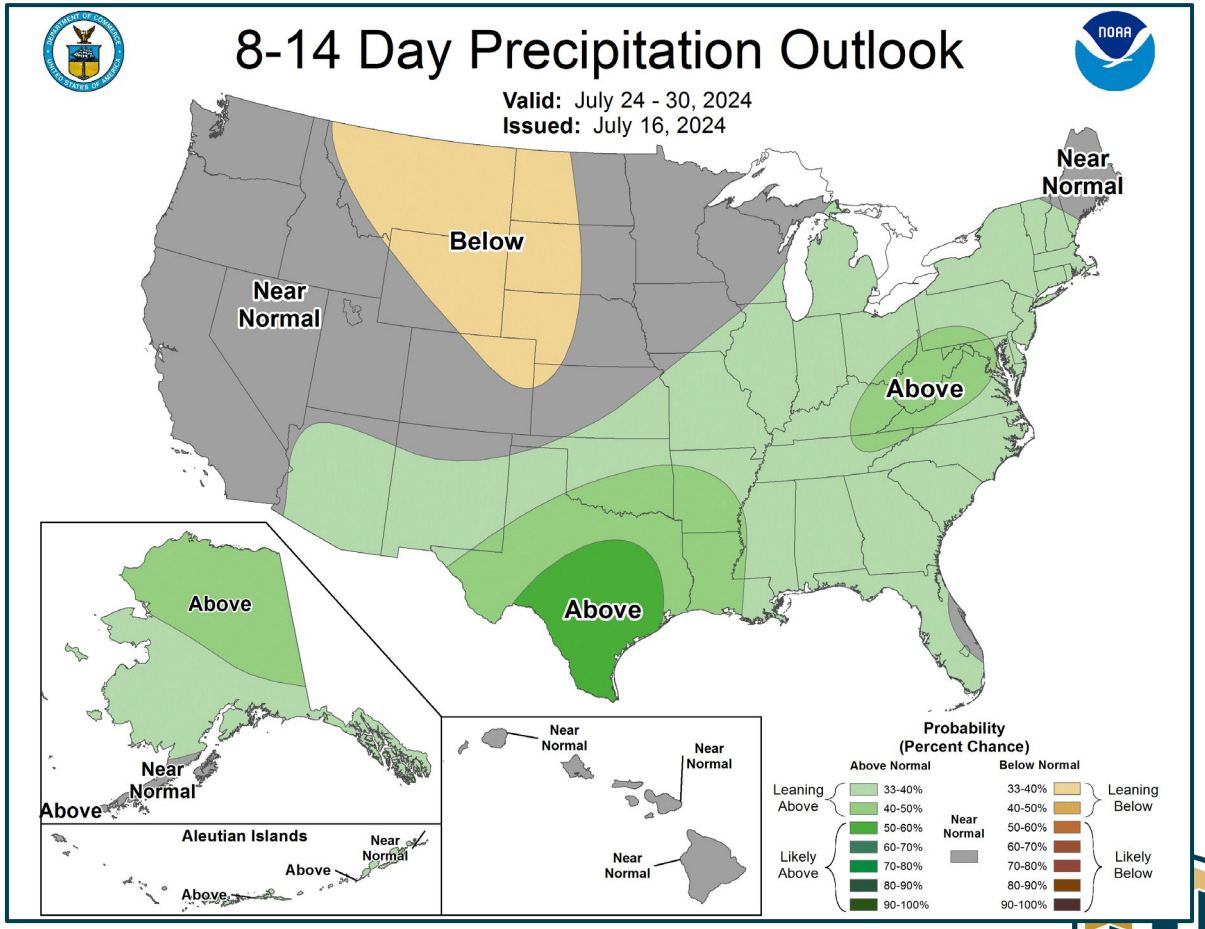
Averaged by Basin, Major Contributing Areas



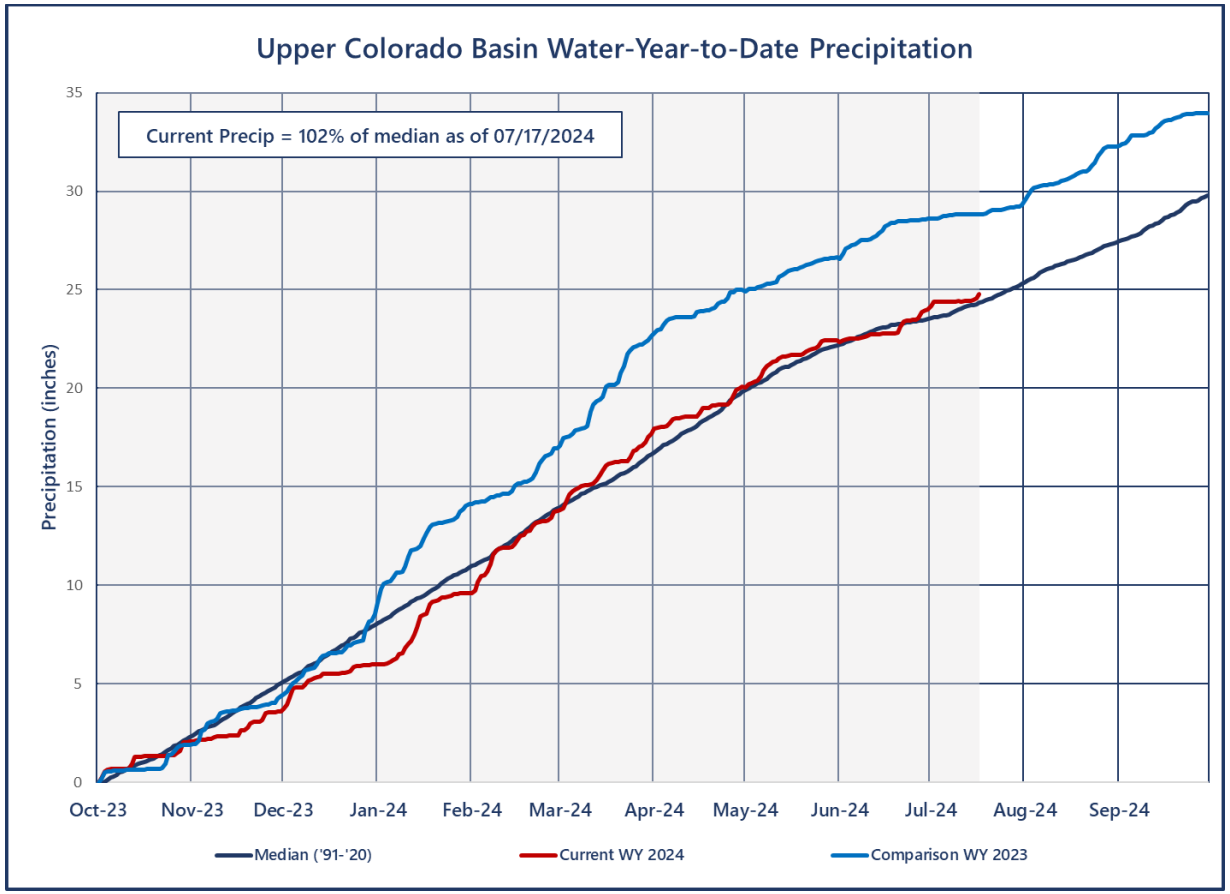
Prepared by NOAA, Colorado Basin River Forecast Center
Salt Lake City, Utah, www.cbrfc.noaa.gov

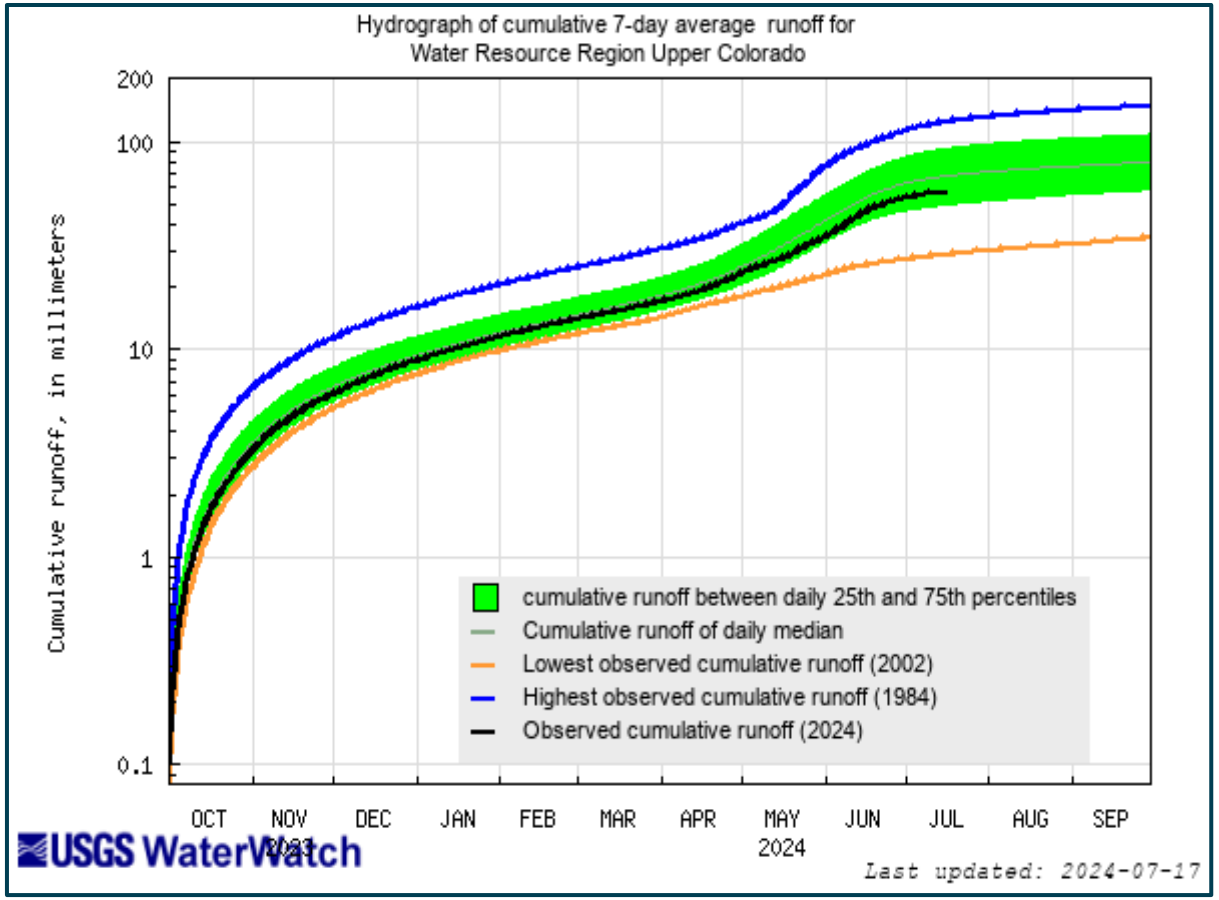
Weather Prediction Center and Climate Prediction Center Precipitation Forecasts





Upper Colorado SWE and Observed Inflows





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

Most Probable July Forecast
Water Year 2024

April – July 2024
Forecasted Unregulated Inflow

as of July 1, 2024

Reservoir	Inflow (kaf)	Change from June	Percent of Avg[1]
Fontenelle	520	-24	71
Flaming Gorge	720	-35	75
Blue Mesa	660	+35	104
Navajo	440	+20	70
Powell	5,400	+300	85

July Midmonth = 5,370 kaf (84%)

Water Year 2024
Unregulated Inflow Forecast

as of July 1, 2024

Reservoir	Inflow (kaf)	Change from June	Percent of Avg[1]
Fontenelle	842	-38	78
Flaming Gorge	1,177	-53	83
Blue Mesa	913	+35	101
Navajo	568	+10	62
Powell	8,131	+340	85

July Midmonth = 8,081 kaf (84%)

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

Most Probable July Forecast
Water Year 2025

April – July 2025
Forecasted Unregulated Inflow

as of July 1, 2024

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	640	87
Flaming Gorge	835	86
Blue Mesa	627	99
Navajo	565	90
Powell	6,060	95

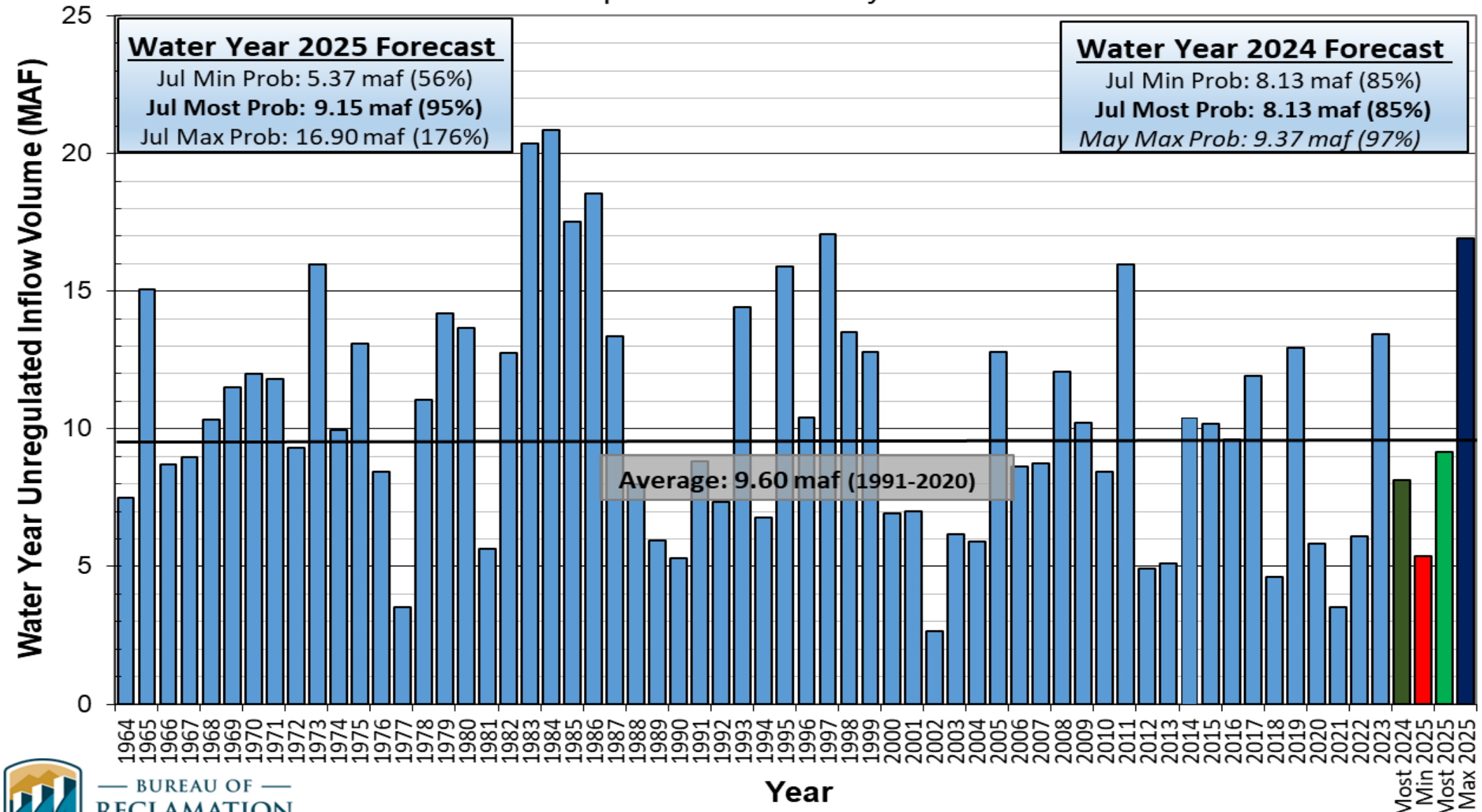
Water Year 2025
Unregulated Inflow Forecast

as of July 1, 2024

Reservoir	Inflow (kaf)	Percent of Avg[1]
Fontenelle	945	88
Flaming Gorge	1,250	89
Blue Mesa	890	98
Navajo	805	88
Powell	9,150	95

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

Lake Powell Unregulated Inflow
Water Year 2024 Forecast *(issued July 1)*
Comparison with History



BUREAU OF RECLAMATION

Upper Colorado Basin

Hydrology and Operations Projections Based on May and July 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
- Includes the Supplemental Environmental Impact Statement for Near-term Colorado River Operations Record of Decision (2024 Near-term SEIS, signed May 6, 2024)
  https://www.usbr.gov/ColoradoRiverBasin/interimguidelines/seis/index.html
- July operations and 24-Month Study will include Glen Canyon Dam Long-Term Experimental and Management Plan Final Supplemental Environmental Impact Statement (2024 LTEMP SEIS ROD, signed July 3, 2024)
  https://www.usbr.gov/uc/DocLibrary/EnvironmentalImpactStatements/GlenCanyonDamLong-TermExperimentalManagementPlan/20240703-GCDLTEMP-FinalSEIS-RecordofDecision-508-AMWD.pdf
- 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.

Summary of Alternatives[1,2]

Elements	No Action Alternative	Preferred Alternative
Shortage Guidelines	Shortages from Lake Mead and DCP contributions of 200,000 af at 1,090 feet to 1.1 maf below 1,025 feet. Shortages are distributed across Lower Basin water users according to priority.	
Coordinated Reservoir Operations	Below 3,575 feet at Lake Powell, release 8.23 or 7.48 maf (Mid-Elevation Release Tier) or balance releases between 7.0 and 9.5 maf (Lower Elevation Balancing Tier) depending on the operating tier and elevations at Lake Powell and Lake Mead.	Same as the No Action Alternative, **except below 3,575 feet at Lake Powell, releases could be as low as 6.0 maf**. Sub-annual releases would comply with the LTEMP and would not drop below LTEMP minimum flows, with the goal of keeping the Lake Powell elevation above 3,500 feet.
Implementation of Guidelines	Mid-year review may adjust Lake Powell operational tier up or down or reduce shortages from Lake Mead (allow additional deliveries to Lower Basin water users)	For Lake Mead, if the April 24-Month Study indicates the end-of-year elevation in Lake Mead will fall below 1,025 feet, Lower Division States have 45 calendar days to propose an implementable plan to protect Lake Mead from reaching an elevation of 1,000 feet. If an acceptable plan is not developed, Reclamation may independently take action(s) to protect 1,000 feet.
Lower Basin SEIS Conservation	Modeled 665,000 af in 2023-2026	**3.0 maf of SEIS conservation through 2026** with a minimum of 1.5 maf conserved by the end of operating year 2024 (approximately 750,000 af per year[1])

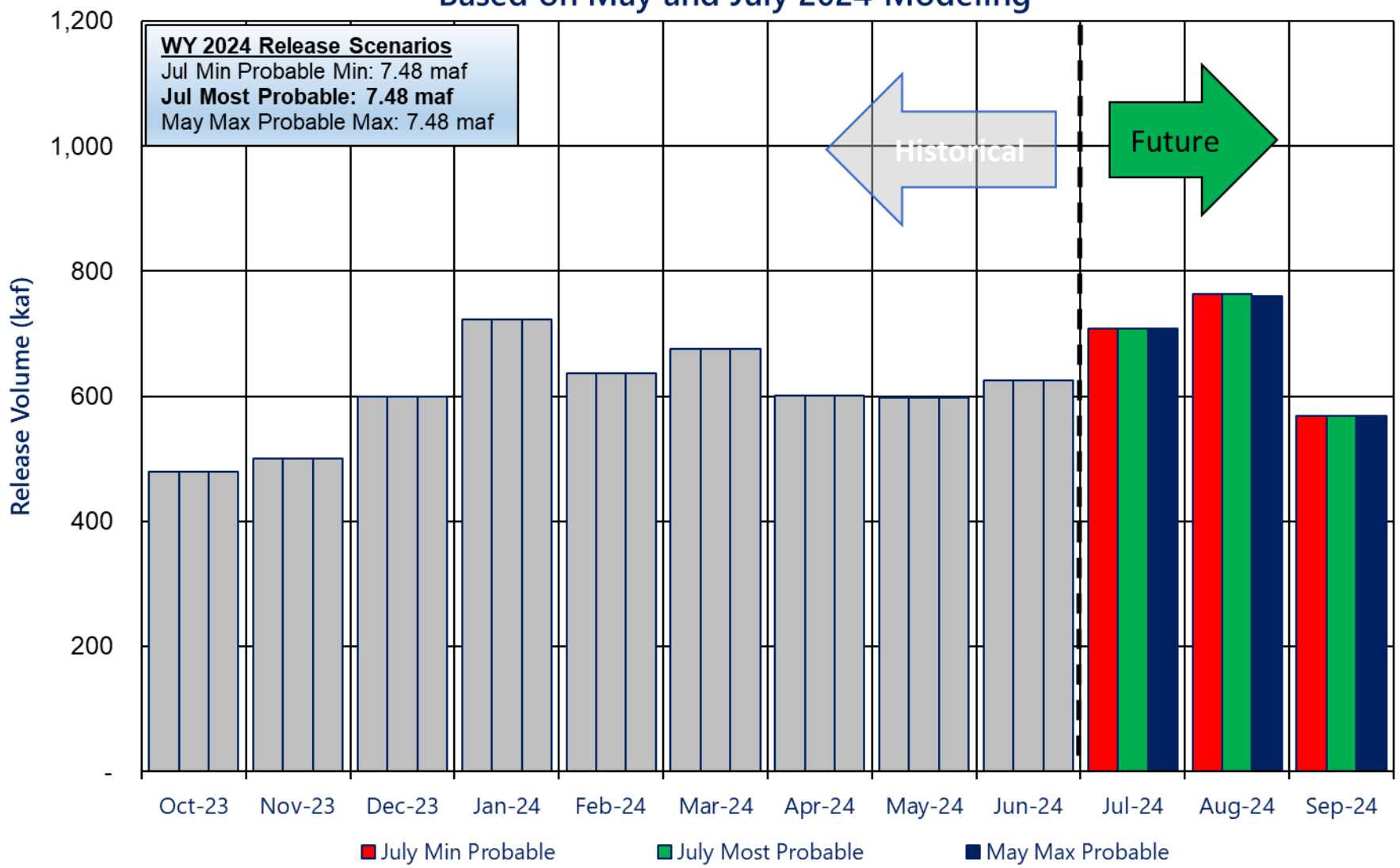
[1] The amount of SEIS conservation could vary in a given year depending on the conservation agreements in place in that year. The total of ROD shortages, DCP contributions, SEIS conservation, and any other additional conservation would not exceed a total of 2.083 maf each year.
[2] The 2024 Interim Guidelines SEIS ROD is available online.

af = acre feet; maf = million acre-feet

Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2024

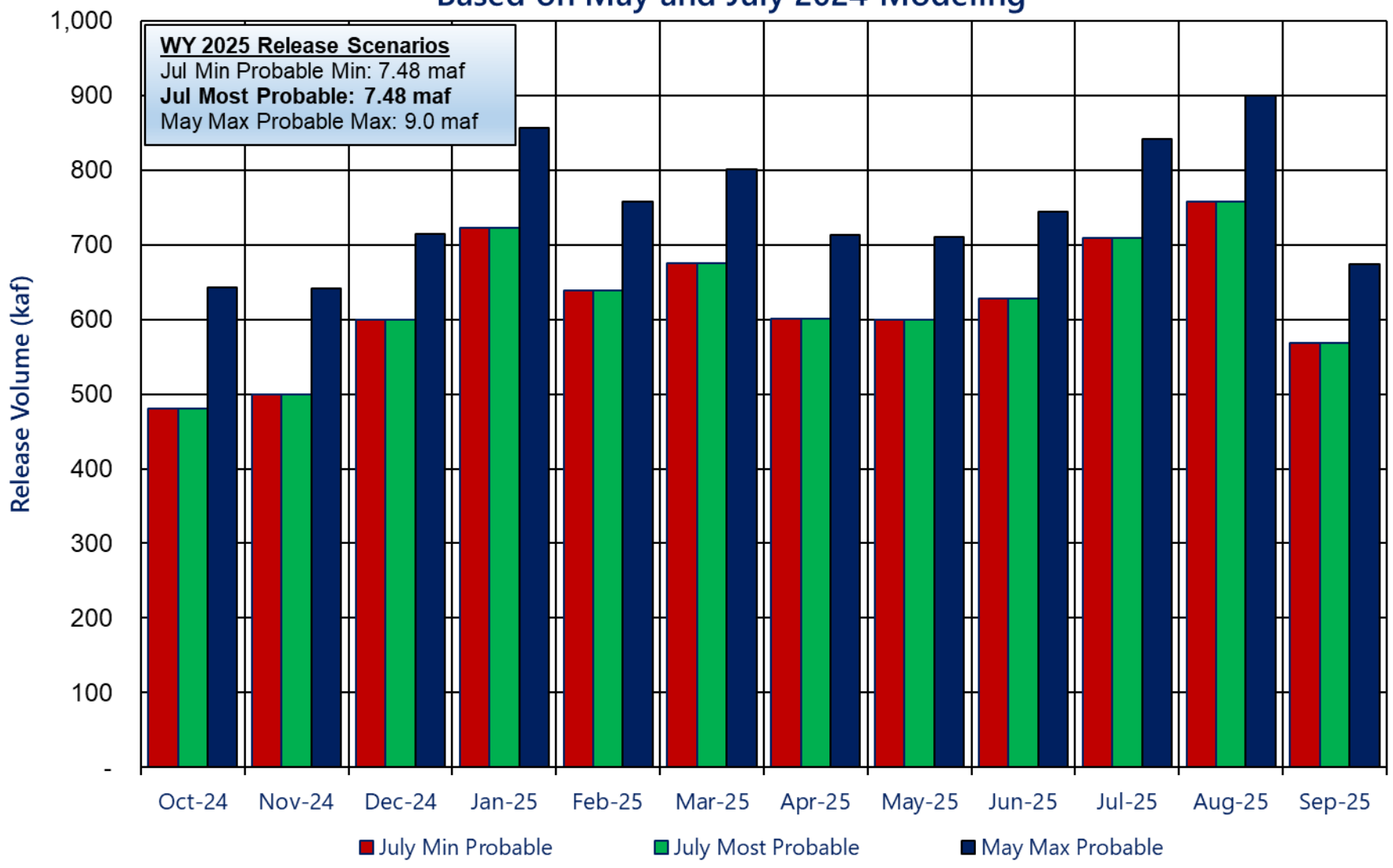
Based on May and July 2024 Modeling



Potential Lake Powell Monthly Release Volume Distribution

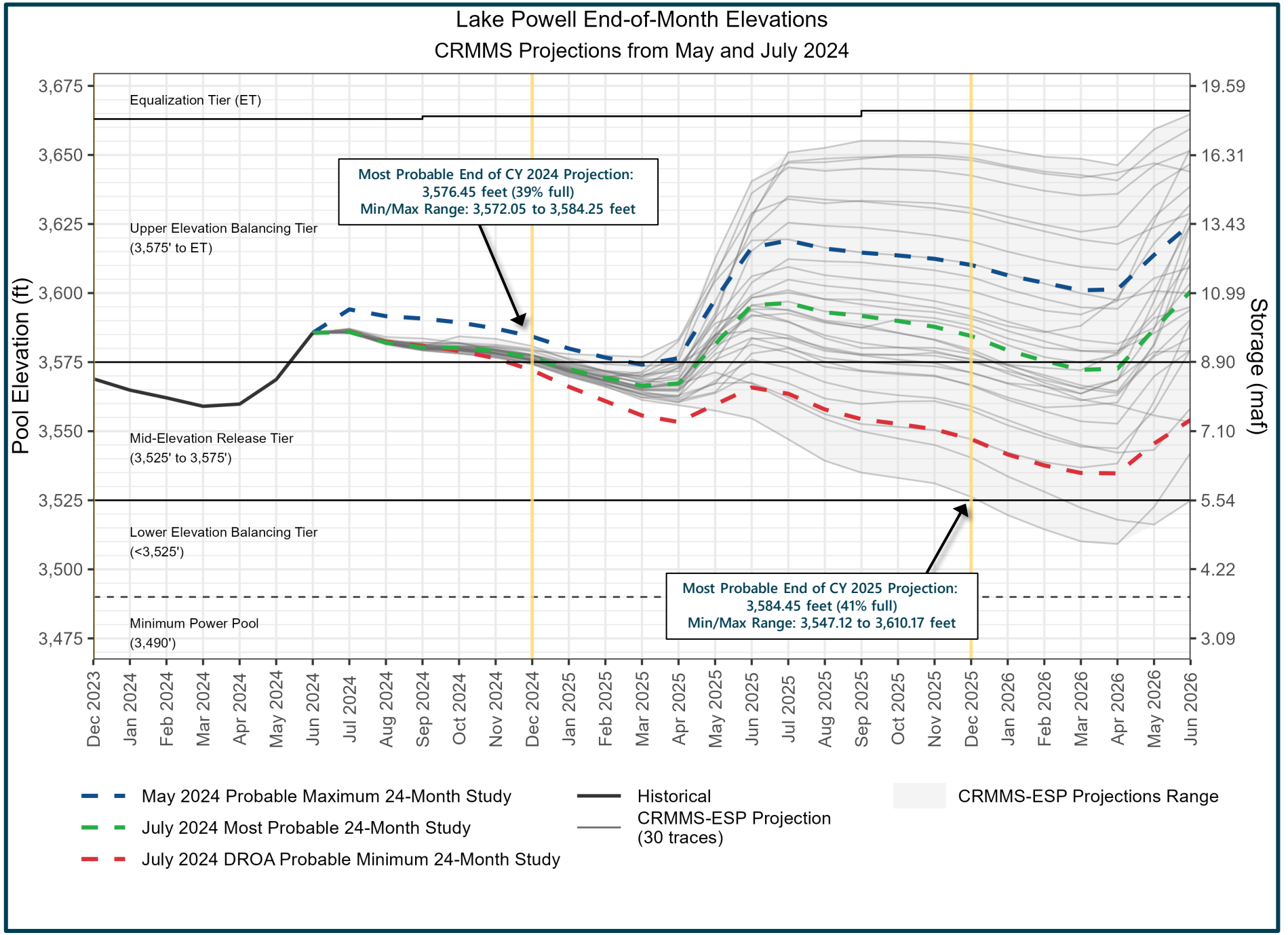
Release Scenarios for Water Year 2025

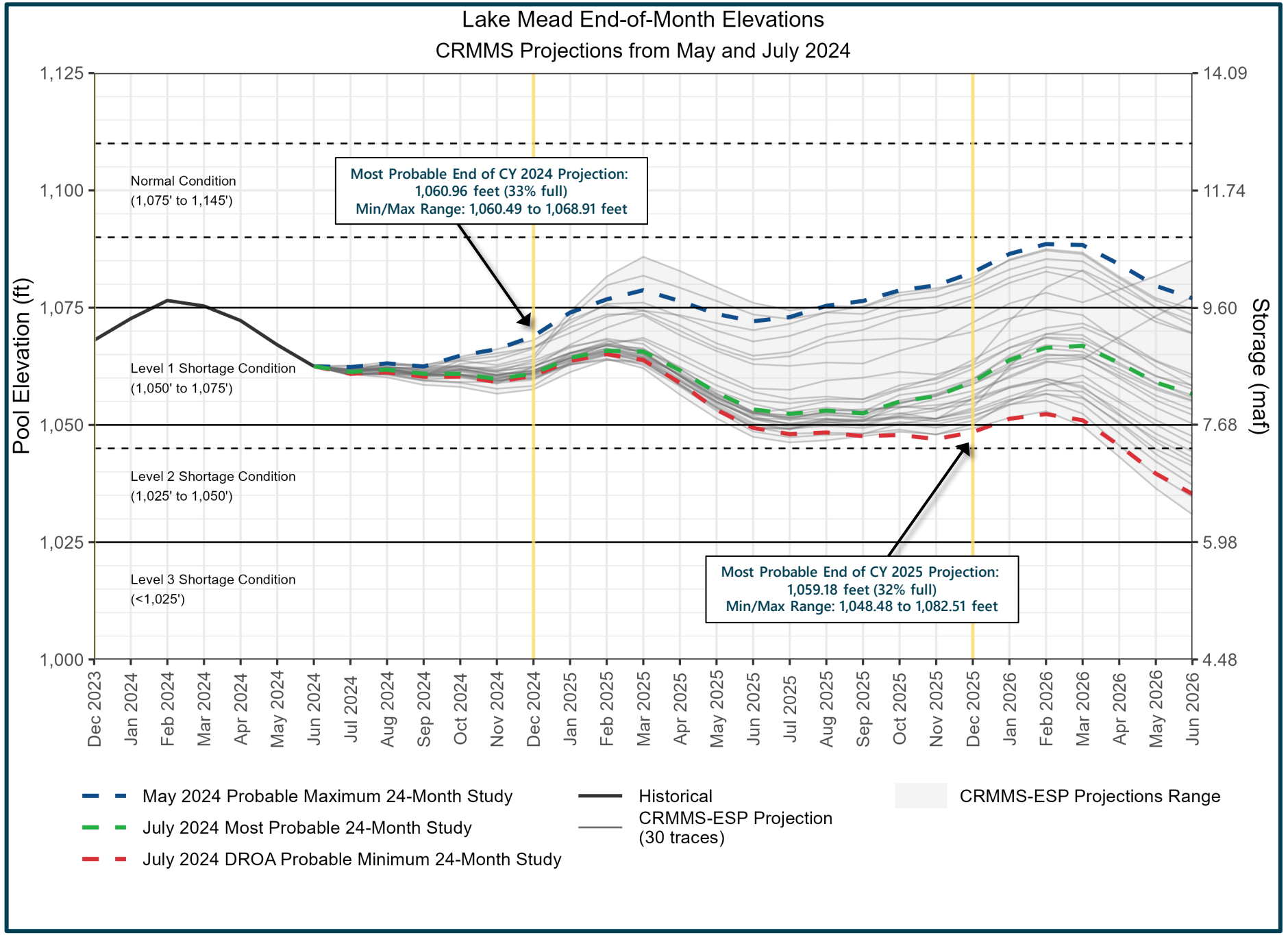
Based on May and July 2024 Modeling



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 May and July 2024
Pool Elevation (ft)
Storage (maf)
3,675
3,650
3,625
3,600
3,575
3,550
3,525
3,500
3,475
19.59
16.31
13.43
10.99
8.90
7.10
5.54
4.22
3.09
Equalization Tier (ET)
Upper Elevation Balancing Tier
(3,575' to ET)
Mid-Elevation Release Tier
(3,525' to 3,575')
Lower Elevation Balancing Tier
(<3,525')
Minimum Power Pool
(3,490')
Most Probable End of CY 2024 Projection:
3,576.45 feet (39% full)
Min/Max Range: 3,572.05 to 3,584.25 feet
Most Probable End of CY 2025 Projection:
3,584.45 feet (41% full)
Min/Max Range: 3,547.12 to 3,610.17 feet
Dec 2023
Jan 2024
Feb 2024
Mar 2024
Apr 2024
May 2024
Jun 2024
Jul 2024
Aug 2024
Sep 2024
Oct 2024
Nov 2024
Dec 2024
Jan 2025
Feb 2025
Mar 2025
Apr 2025
May 2025
Jun 2025
Jul 2025
Aug 2025
Sep 2025
Oct 2025
Nov 2025
Dec 2025
Jan 2026
Feb 2026
Mar 2026
Apr 2026
May 2026
Jun 2026
May 2024 Probable Maximum 24-Month Study
July 2024 Most Probable 24-Month Study
July 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 May and July 2024
Pool Elevation (ft)
Storage (maf)
1,125
1,100
1,075
1,050
1,025
1,000
14.09
11.74
9.60
7.68
5.98
4.48
Normal Condition
(1,075' to 1,145')
Level 1 Shortage Condition
(1,050' to 1,075')
Level 2 Shortage Condition
(1,025' to 1,050')
Level 3 Shortage Condition
(<1,025')
Most Probable End of CY 2024 Projection:
1,060.96 feet (33% full)
Min/Max Range: 1,060.49 to 1,068.91 feet
Most Probable End of CY 2025 Projection:
1,059.18 feet (32% full)
Min/Max Range: 1,048.48 to 1,082.51 feet
Dec 2023
Jan 2024
Feb 2024
Mar 2024
Apr 2024
May 2024
Jun 2024
Jul 2024
Aug 2024
Sep 2024
Oct 2024
Nov 2024
Dec 2024
Jan 2025
Feb 2025
Mar 2025
Apr 2025
May 2025
Jun 2025
Jul 2025
Aug 2025
Sep 2025
Oct 2025
Nov 2025
Dec 2025
Jan 2026
Feb 2026
Mar 2026
Apr 2026
May 2026
Jun 2026
May 2024 Probable Maximum 24-Month Study
July 2024 Most Probable 24-Month Study
July 2024 DROA Probable Minimum 24-Month Study
Historical
CRMMS-ESP Projection
(30 traces)
CRMMS-ESP Projections Range

Upper Colorado Basin

Hydropower Maintenance

Glen Canyon Dam Power Plant Unit Outage Schedule for 2024

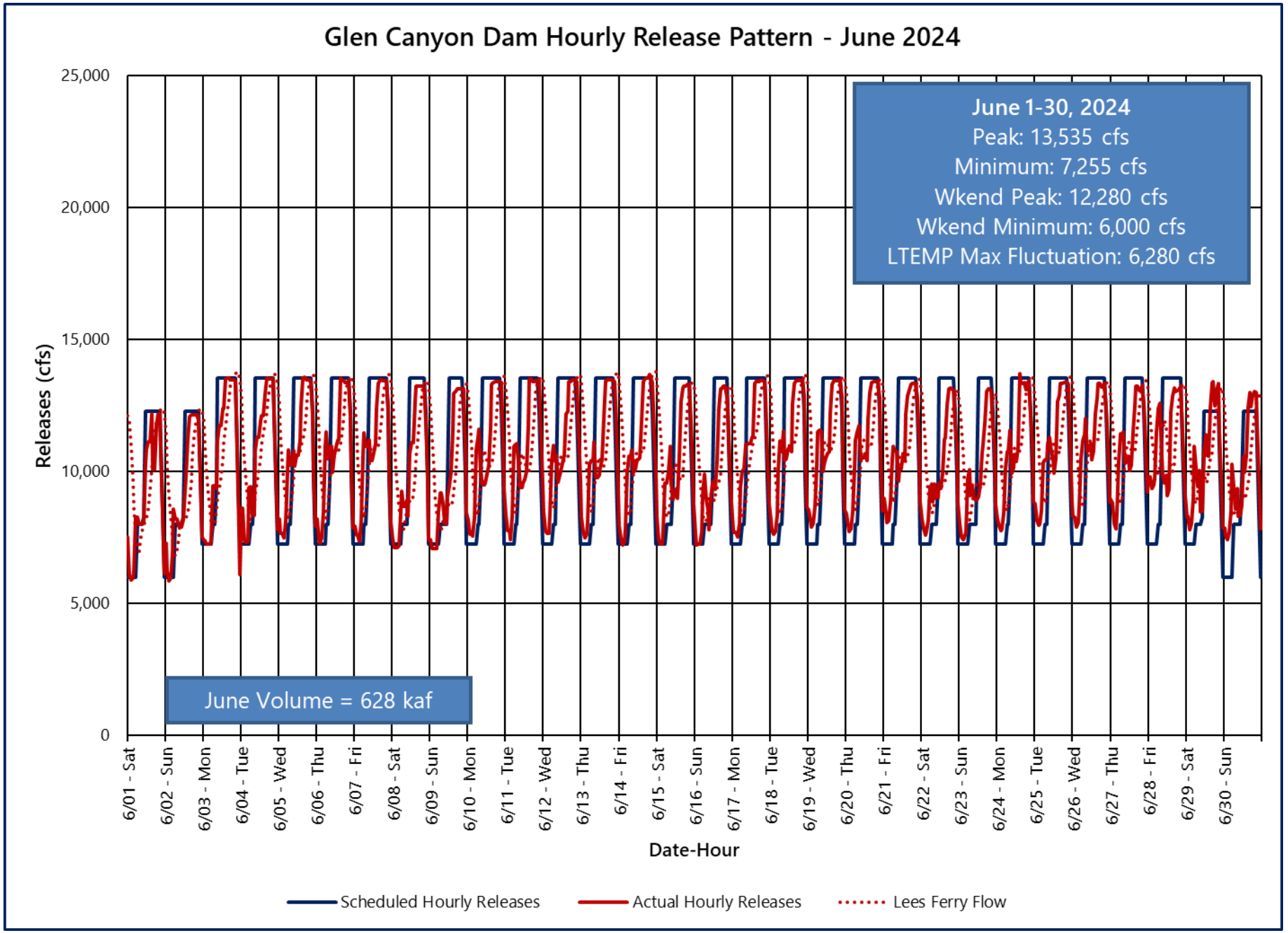
Unit Number	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	
1													
2													
3													
4													
5													
6													
7													
8													
ROW 1													
ROW 2													
ROW 3													
ROW 4													
Units Available	4	4	6	6	6	6	6	5	8	8	7	6	
Penstock Capacity (cfs)	12,400	19,450	19,400	19,300	19,200	19,100	19,100	16,000	27,000	27,000	23,400[3]	19,700	JUL MOST[2]
Penstock Capacity (kaf/month)	770	1,030	1,190	1,190	1,100	1,220	1,280	1,030	1,600	1,660	1,570	1,200	JUL MOST
Max (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	567	7.48 maf
Most (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	567	7.48 maf
Min (kaf) [1]	480	500	600	723	639	675	601	599	628	709	758	567	7.48 maf
										(updated 07-17-2024)			

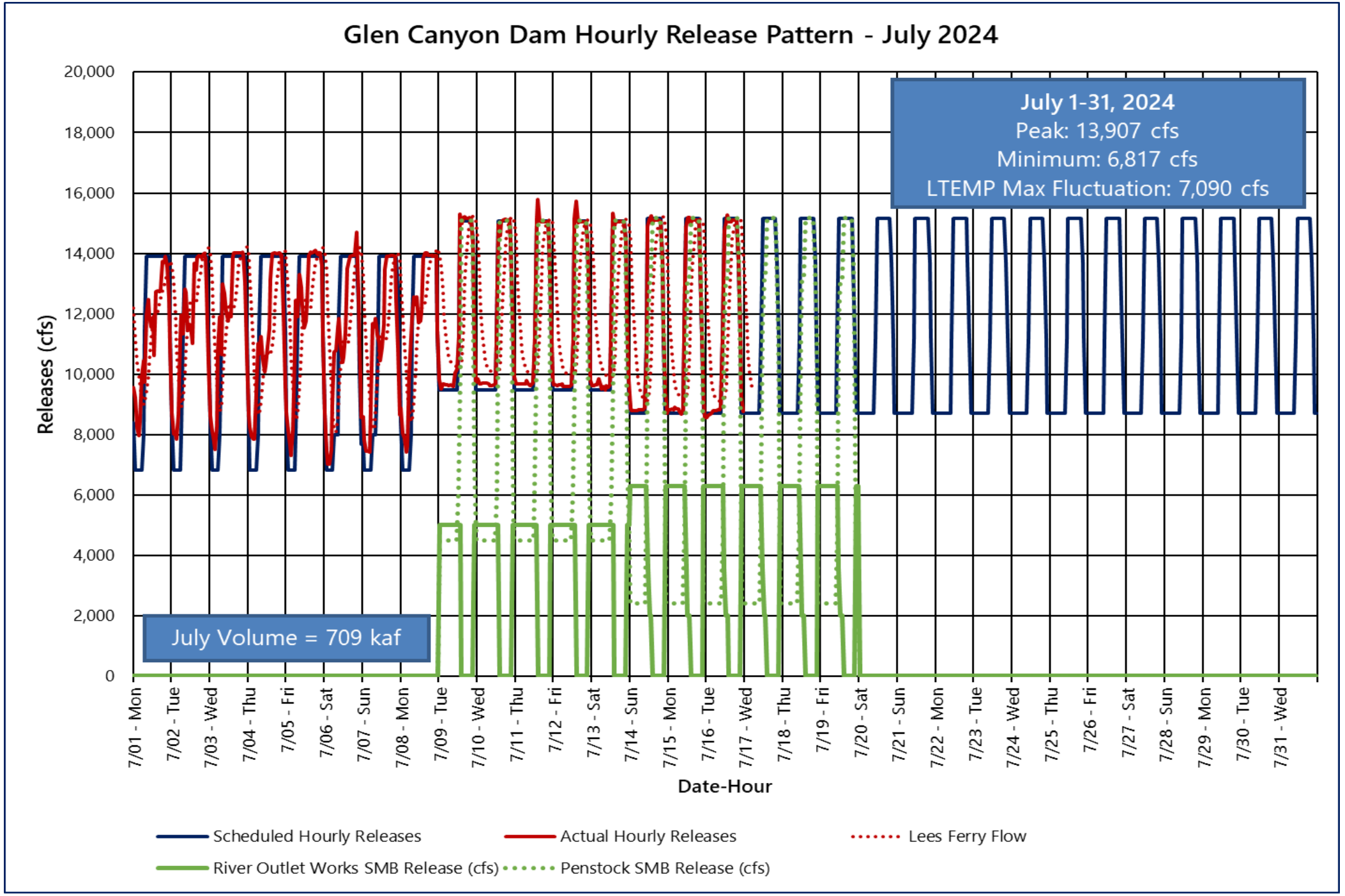
1 Projected release, based on July 2024 24MS for the minimum and most probable and the May 2024 24MS maximum probable 24-Month Study model runs.
2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.
3 NERC testing with occasional removal of penstock generating capacity.

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													
ROW 1													
ROW 2													
ROW 3													
ROW 4													
Units Available	5	6	8	6	6	6	7	7	8	8	8	6	
Penstock Capacity (cfs)	16,100/ 4,000[3]	19,700	27,000	19,700	19,700	19,700	23,300	23,300	26,900	27,000	27,000	19,700	JUL MOST[2]
Penstock Capacity (kaf/month)	1,200	1,500	1,660	1,580	1,110	1,240	1,390	1,600	1,600	1,660	1,660	1,190	JUL 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 07-17-2024)			

1 Projected release, based on July 2024 24MS for the minimum and most probable and the May 2024 24MS 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.
3 Tailwater/Forebay inspection from October 21-24 will require one day at 4,000 cfs, and possibly two if necessary.

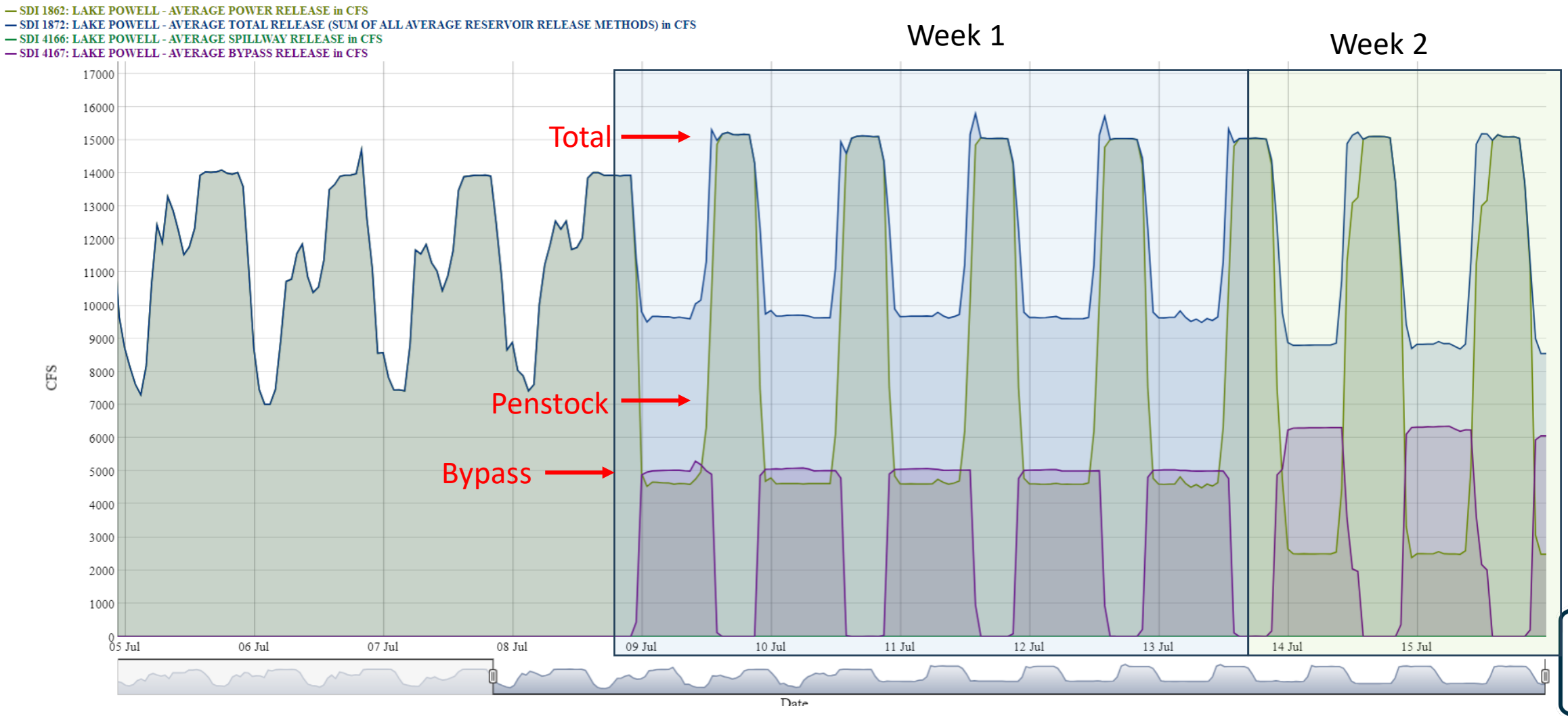

Glen Canyon Dam Hourly Release Pattern - June 2024
June 1-30, 2024
Peak: 13,535 cfs
Minimum: 7,255 cfs
Wkend Peak: 12,280 cfs
Wkend Minimum: 6,000 cfs
LTEMP Max Fluctuation: 6,280 cfs
June Volume = 628 kaf
Releases (cfs)
25,000
20,000
15,000
10,000
5,000
0
6/01 - Sat
6/02 - Sun
6/03 - Mon
6/04 - Tue
6/05 - Wed
6/06 - Thu
6/07 - Fri
6/08 - Sat
6/09 - Sun
6/10 - Mon
6/11 - Tue
6/12 - Wed
6/13 - Thu
6/14 - Fri
6/15 - Sat
6/16 - Sun
6/17 - Mon
6/18 - Tue
6/19 - Wed
6/20 - Thu
6/21 - Fri
6/22 - Sat
6/23 - Sun
6/24 - Mon
6/25 - Tue
6/26 - Wed
6/27 - Thu
6/28 - Fri
6/29 - Sat
6/30 - Sun
Date-Hour
Scheduled Hourly Releases
Actual Hourly Releases
Lees Ferry Flow


Glen Canyon Dam Hourly Release Pattern - July 2024
July 1-31, 2024
Peak: 13,907 cfs
Minimum: 6,817 cfs
LTEMP Max Fluctuation: 7,090 cfs
July Volume = 709 kaf
Releases (cfs)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
7/01 - Mon
7/02 - Tue
7/03 - Wed
7/04 - Thu
7/05 - Fri
7/06 - Sat
7/07 - Sun
7/08 - Mon
7/09 - Tue
7/10 - Wed
7/11 - Thu
7/12 - Fri
7/13 - Sat
7/14 - Sun
7/15 - Mon
7/16 - Tue
7/17 - Wed
7/18 - Thu
7/19 - Fri
7/20 - Sat
7/21 - Sun
7/22 - Mon
7/23 - Tue
7/24 - Wed
7/25 - Thu
7/26 - Fri
7/27 - Sat
7/28 - Sun
7/29 - Mon
7/30 - Tue
7/31 - Wed
Date-Hour
Scheduled Hourly Releases
Actual Hourly Releases
Lees Ferry Flow
River Outlet Works SMB Release (cfs)
Penstock SMB Release (cfs)

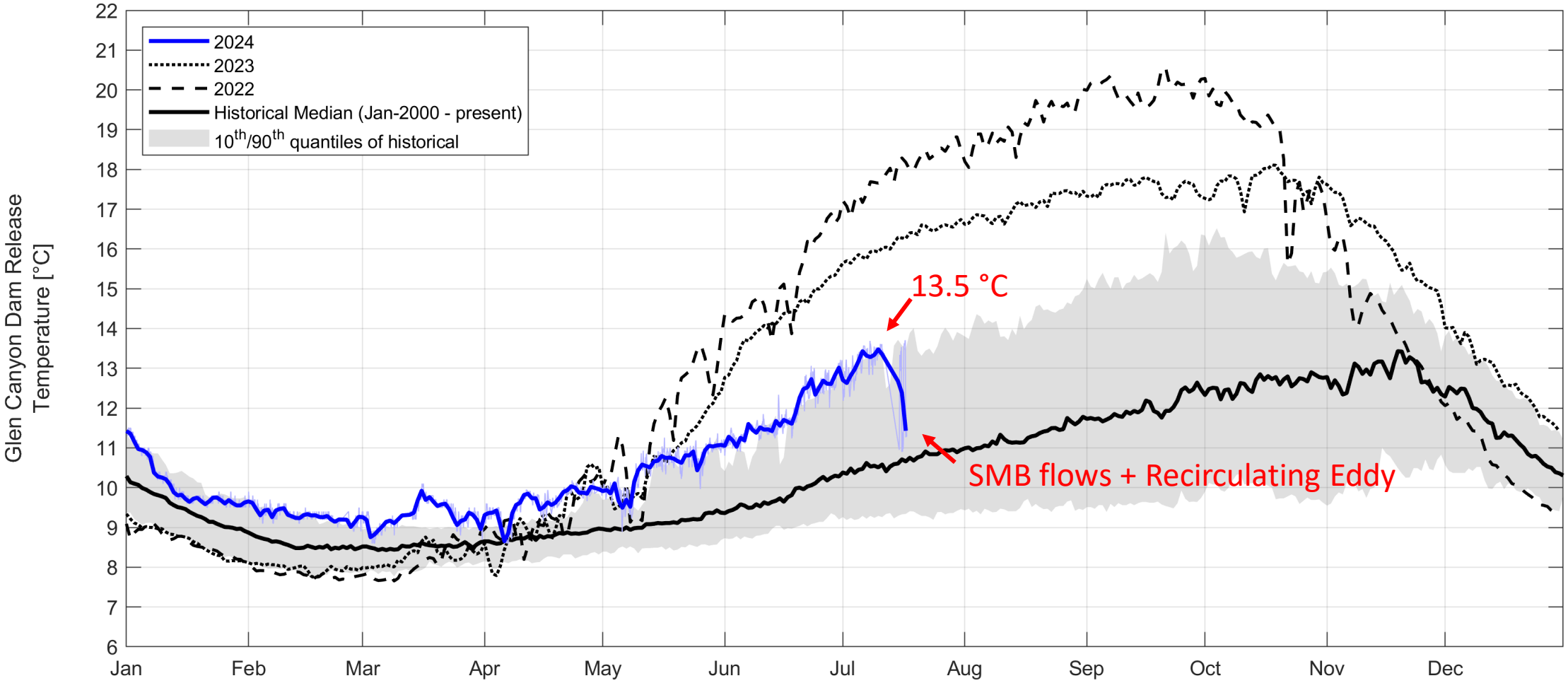
Water Quality Update

7/15/2024

SMB Flows


SDI 1862: LAKE POWELL - AVERAGE POWER RELEASE in CFS
SDI 1872: LAKE POWELL - AVERAGE TOTAL RELEASE (SUM OF ALL AVERAGE RESERVOIR RELEASE METHODS) in CFS
SDI 4166: LAKE POWELL - AVERAGE SPILLWAY RELEASE in CFS
SDI 4167: LAKE POWELL - AVERAGE BYPASS RELEASE in CFS
Week 1
Week 2
Total
Penstock
Bypass
CFS
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
05 Jul
06 Jul
07 Jul
08 Jul
09 Jul
10 Jul
11 Jul
12 Jul
13 Jul
14 Jul
15 Jul
Date

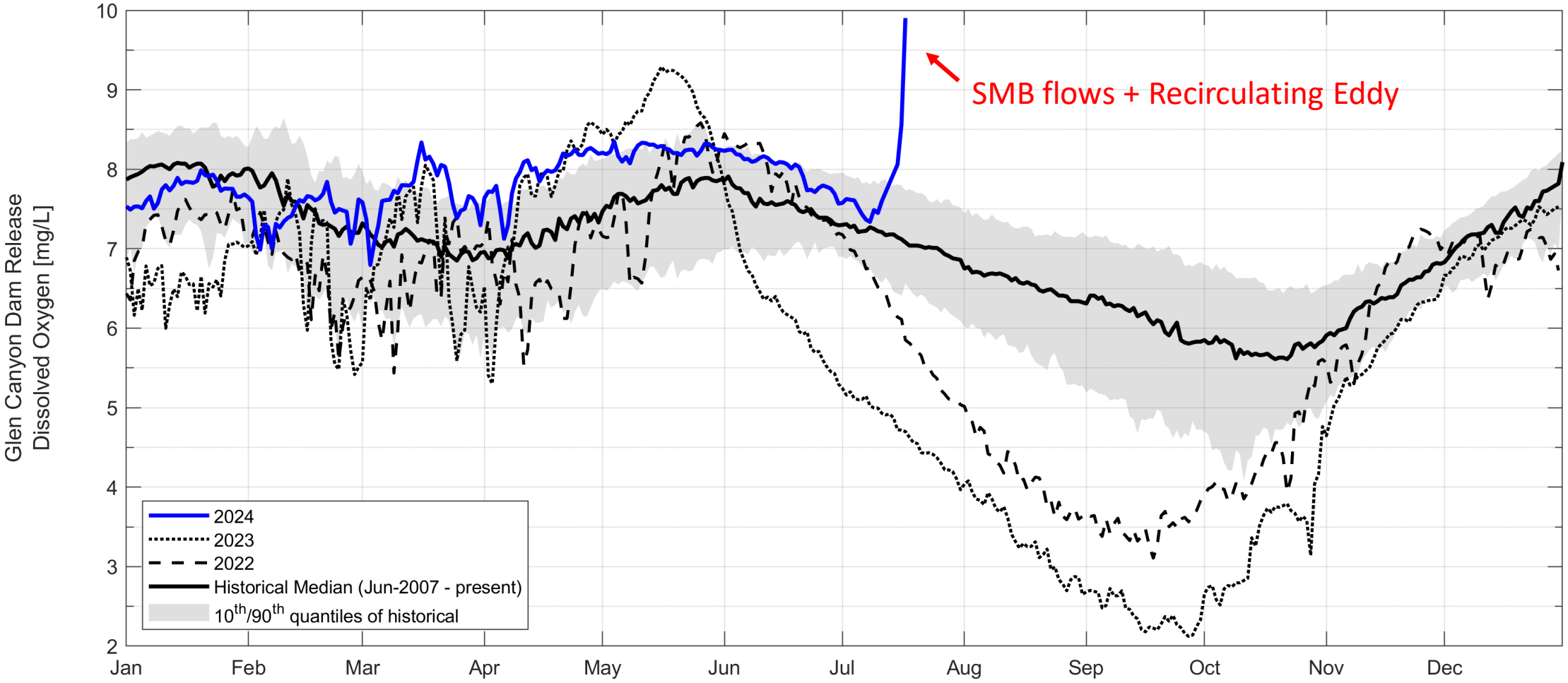
Glen Canyon Dam Observations - Temperature



As of 7/17/2024

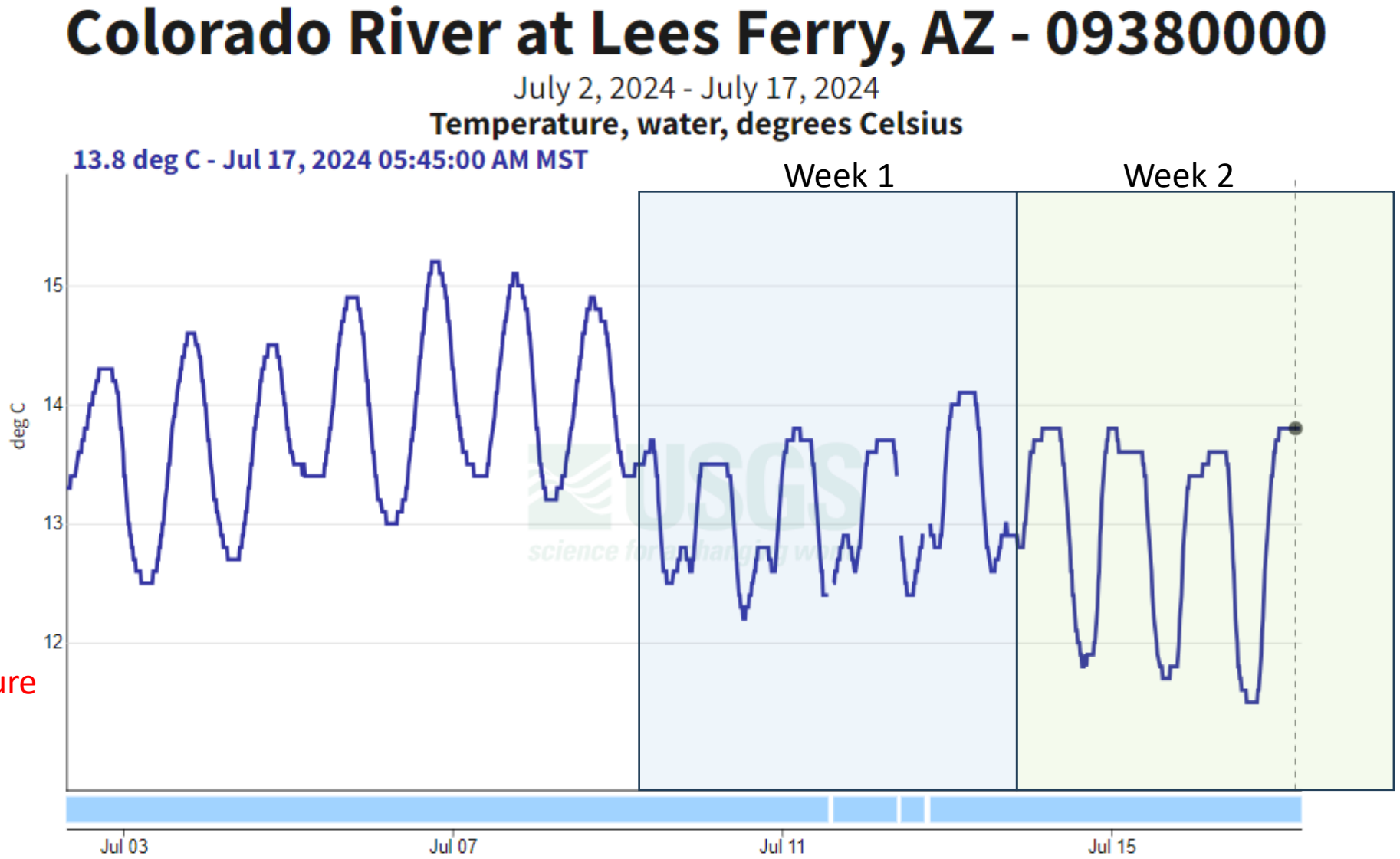
Glen Canyon Dam Observations

Glen Canyon Dam Observations – Dissolved Oxygen



As of 7/17/2024

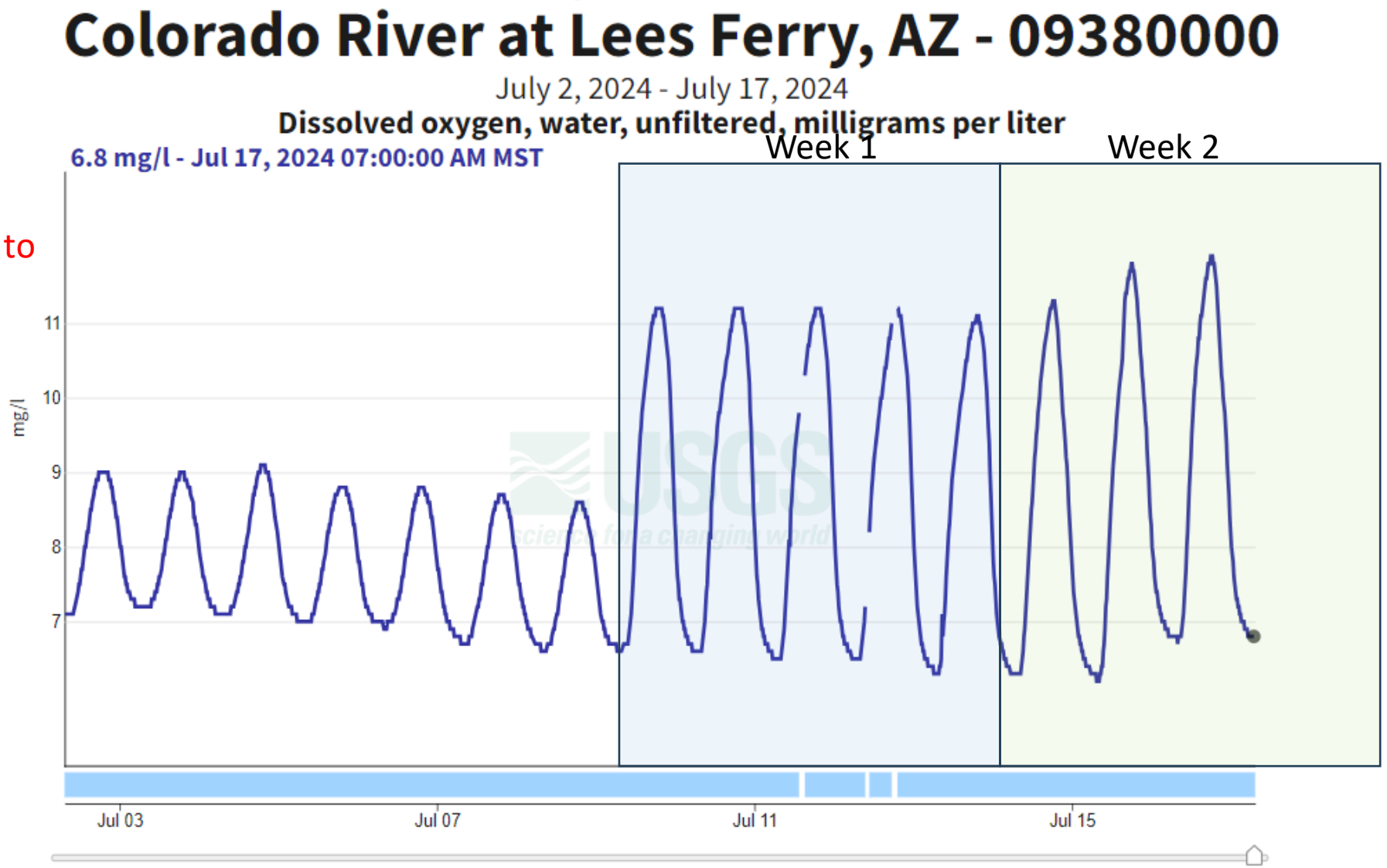
Lees Ferry Observations - Temperature



Drop in temperature due to SMB Flows

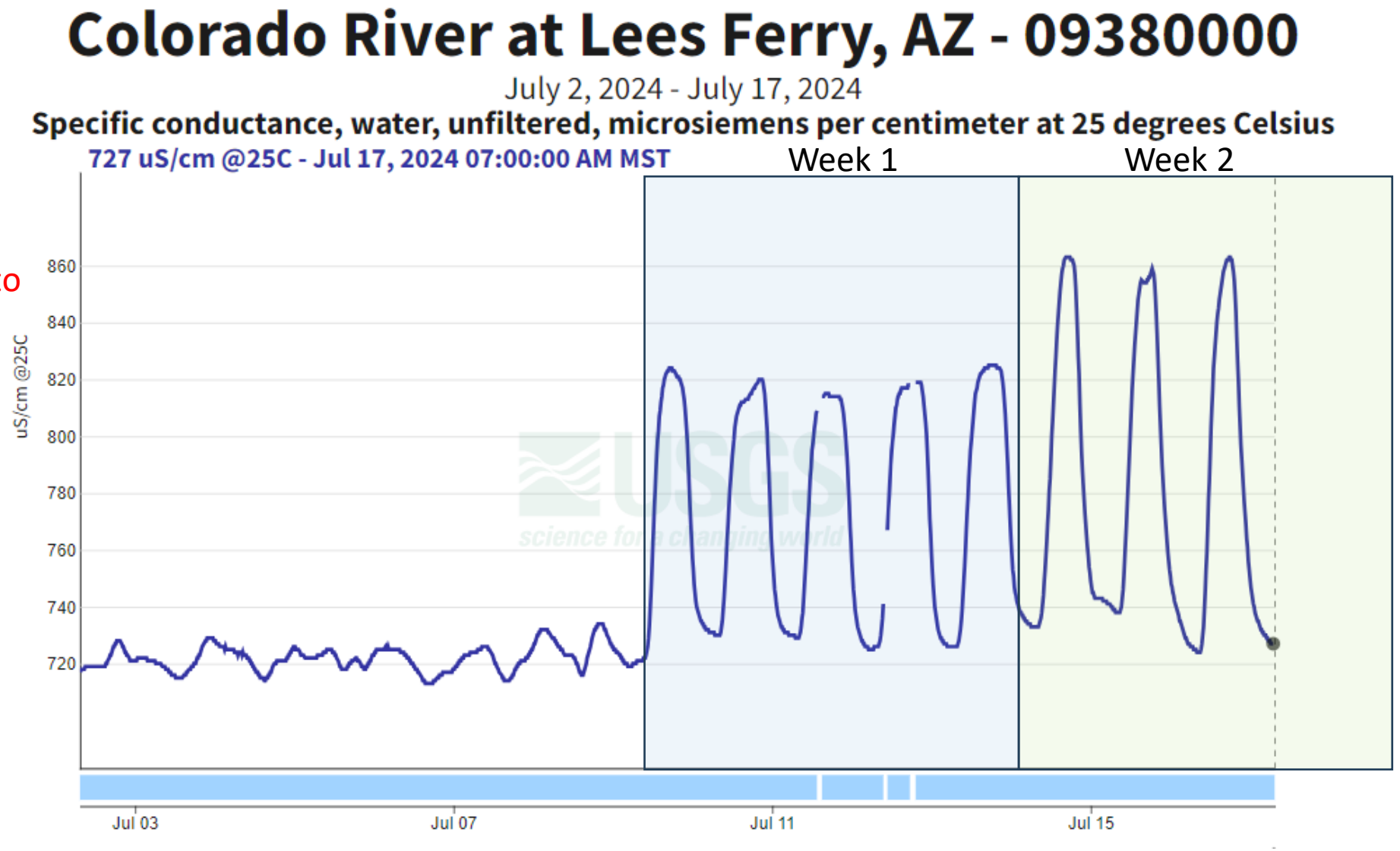
Lees Ferry Observations – Dissolved Oxygen

Increased DO due to SMB Flows

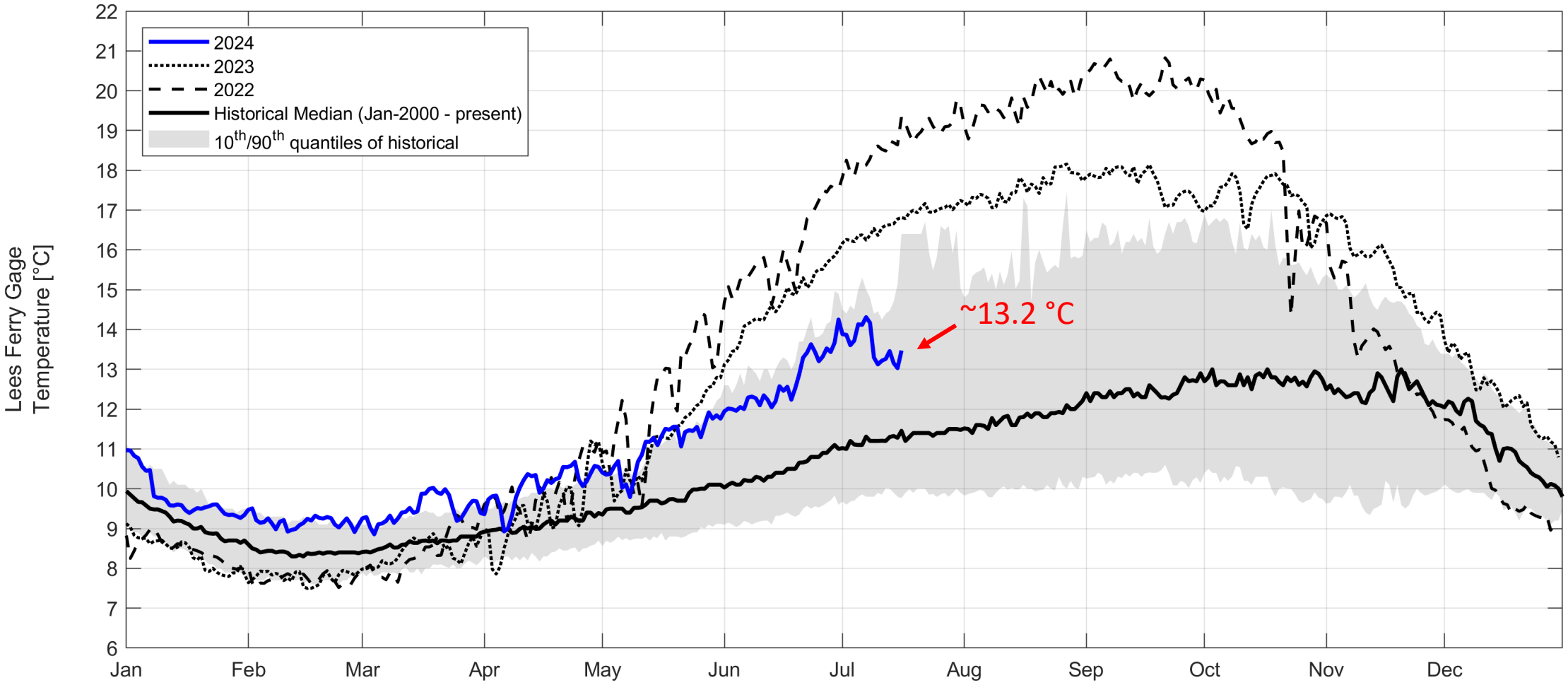


Lees Ferry Observations – Specific Conductivity

Increased Specific Conductivity due to SMB Flows

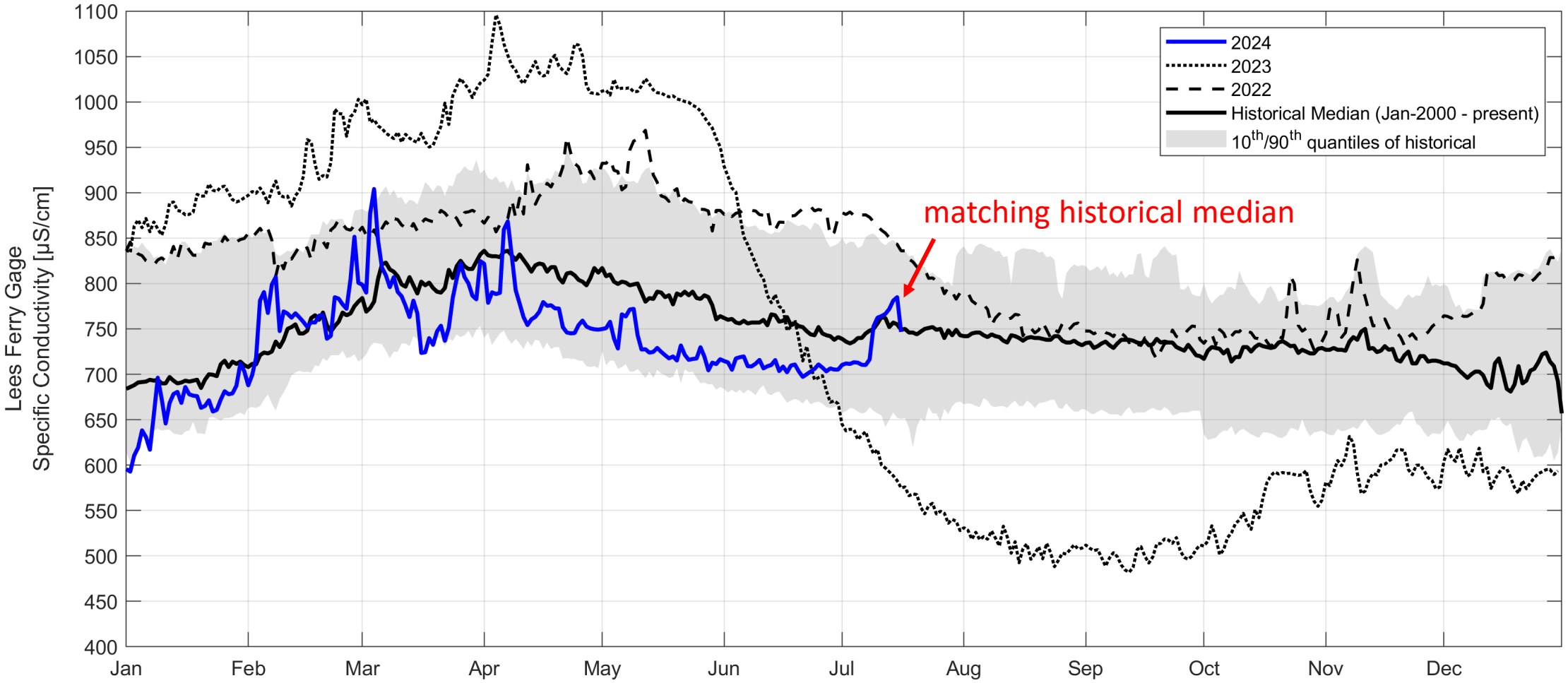


Lees Ferry Observations - Temperature



As of 7/17/2024

Lees Ferry Observations – Specific Conductivity



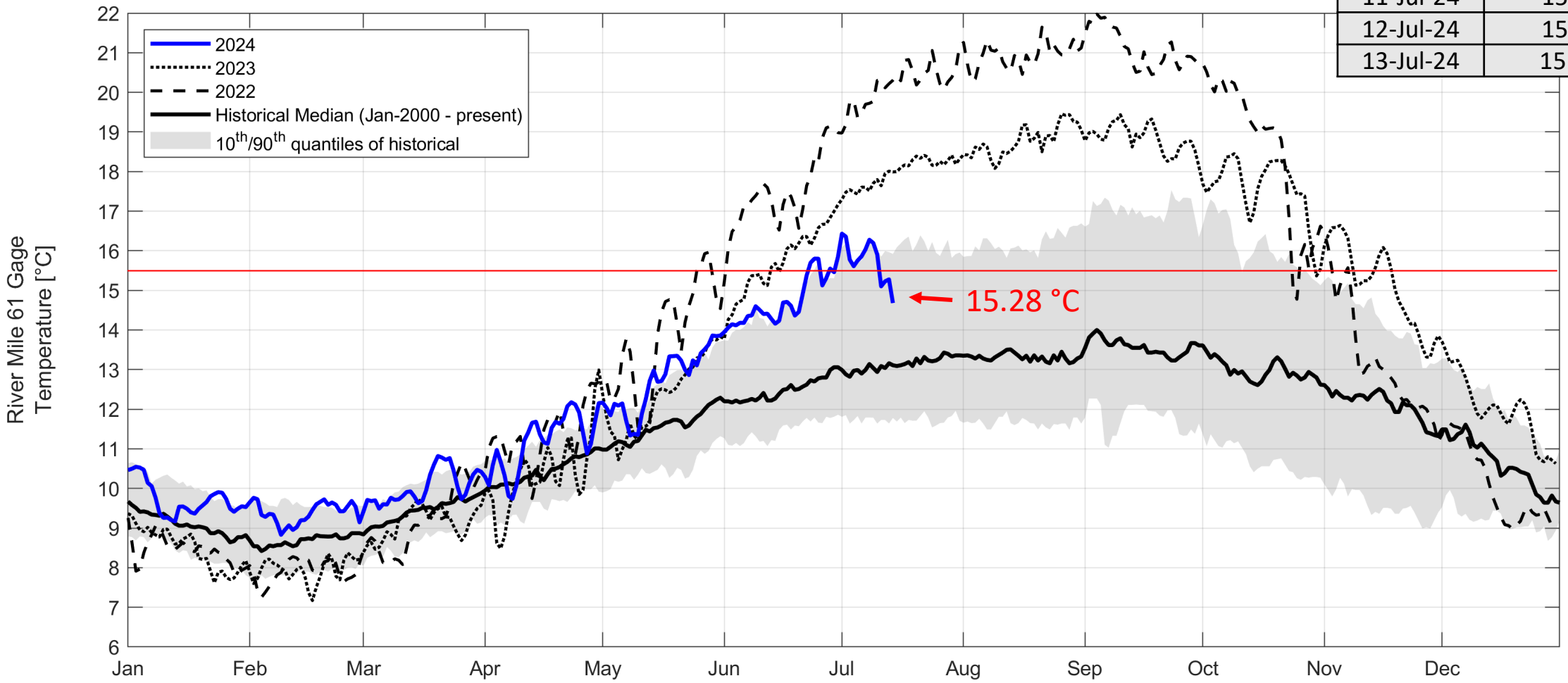
As of 7/17/2024

RM 61 Observations - Temperature

SMB Flows Start

(Daily Avg.)

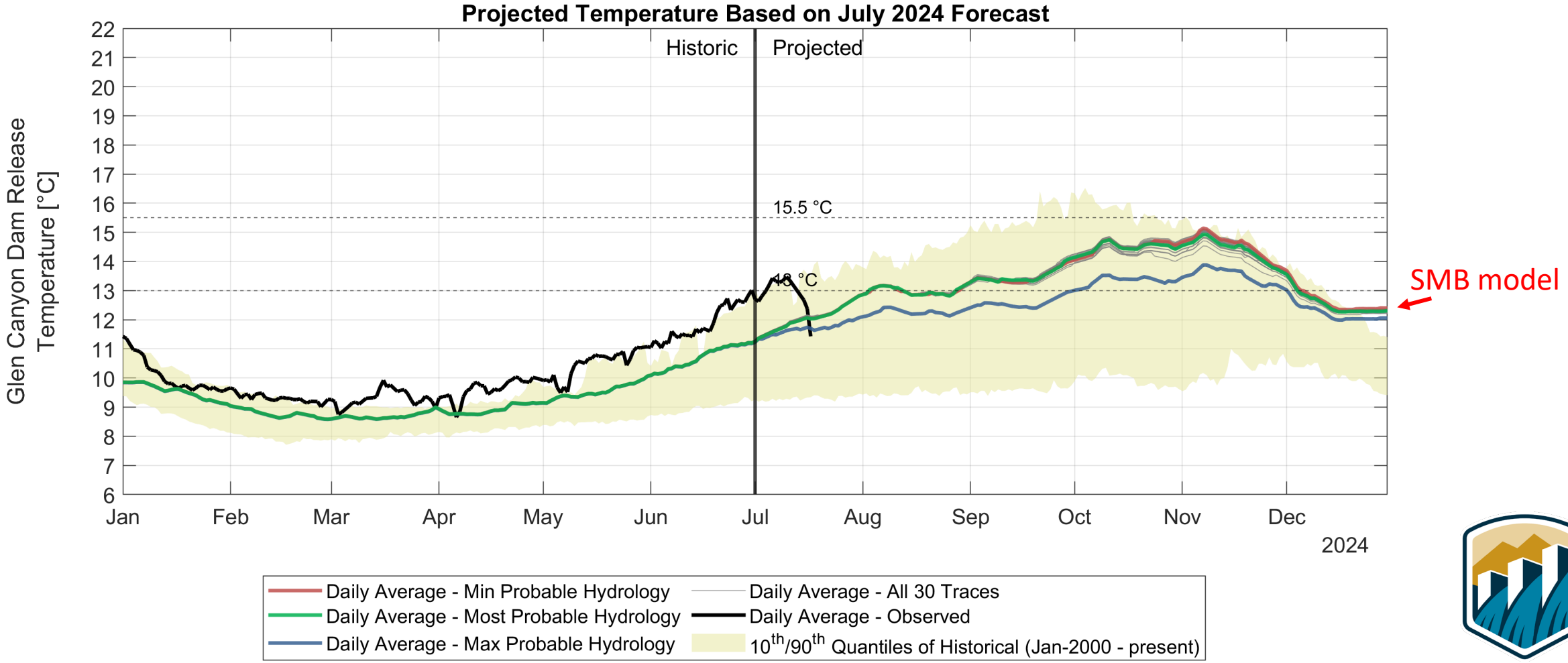
Date	RM61 Temp °C
9-Jul-24	16.196
10-Jul-24	15.907
11-Jul-24	15.102
12-Jul-24	15.228
13-Jul-24	15.277



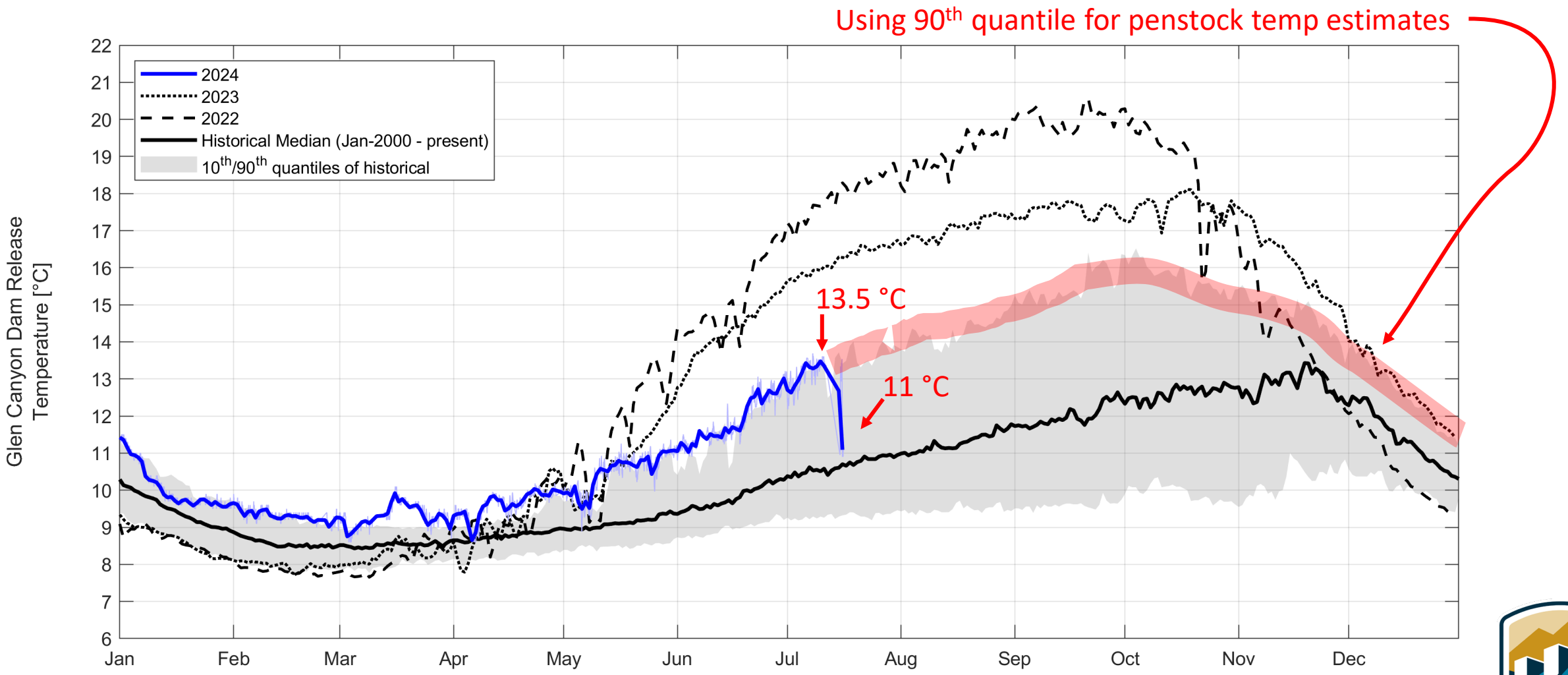
As of 7/14/2024

SMB Model - Lake Powell Release Predictions July 24MS

CE-QAUL-W2 & SMB models not agreeing with current observations

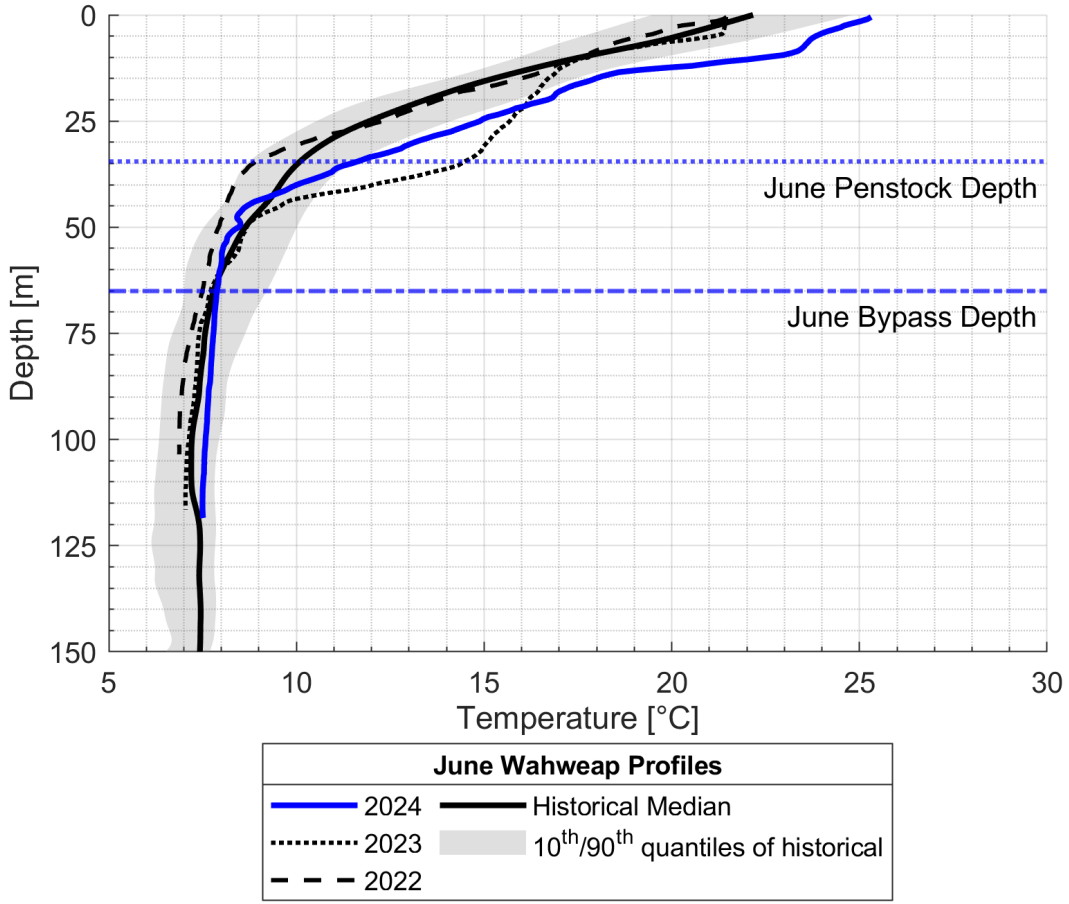


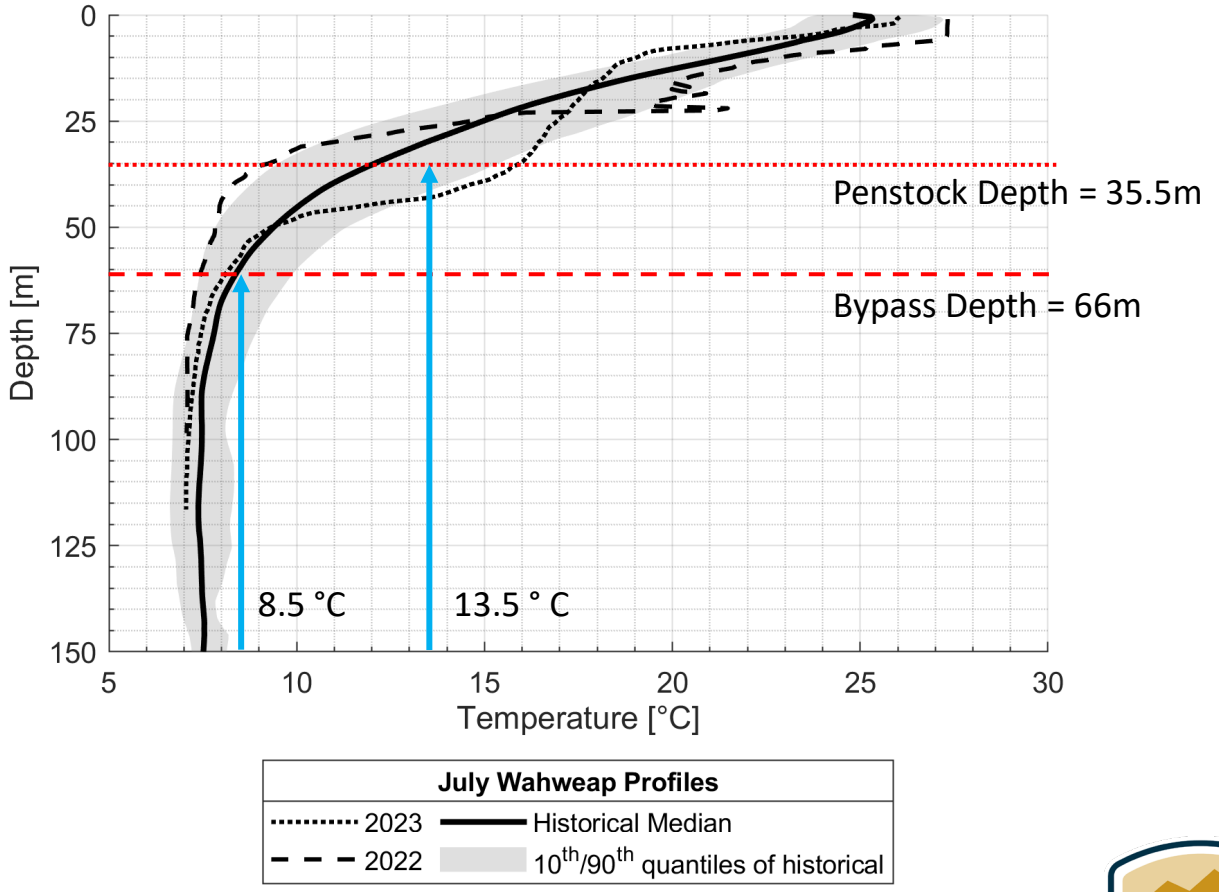
Future Release Temperature Assumption



As of 7/16/2024

Wahweap Observations – Temperature Profiles

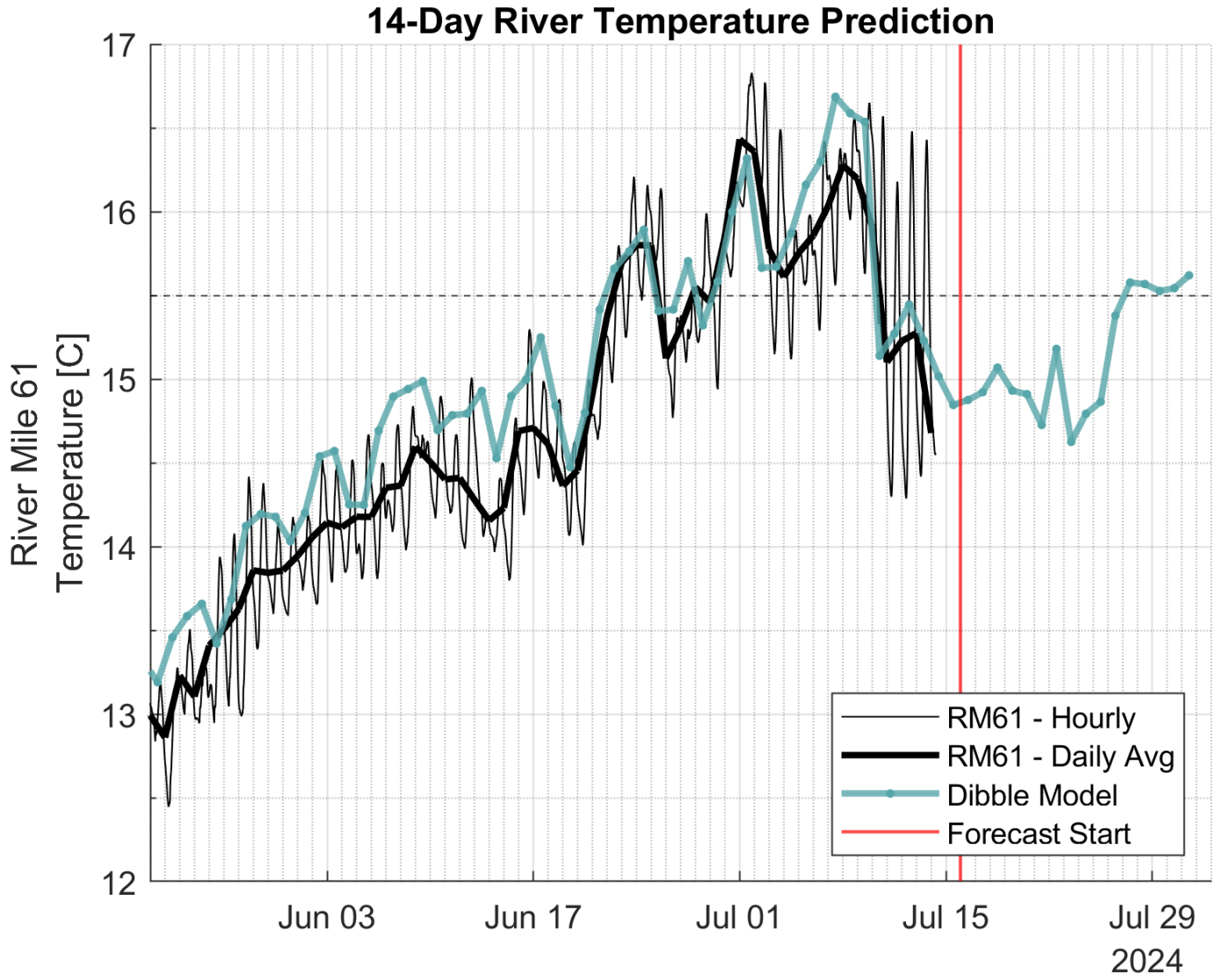




RM 61 River Temp Prediction – Dibble Model (Short – Term)

Model Inputs:

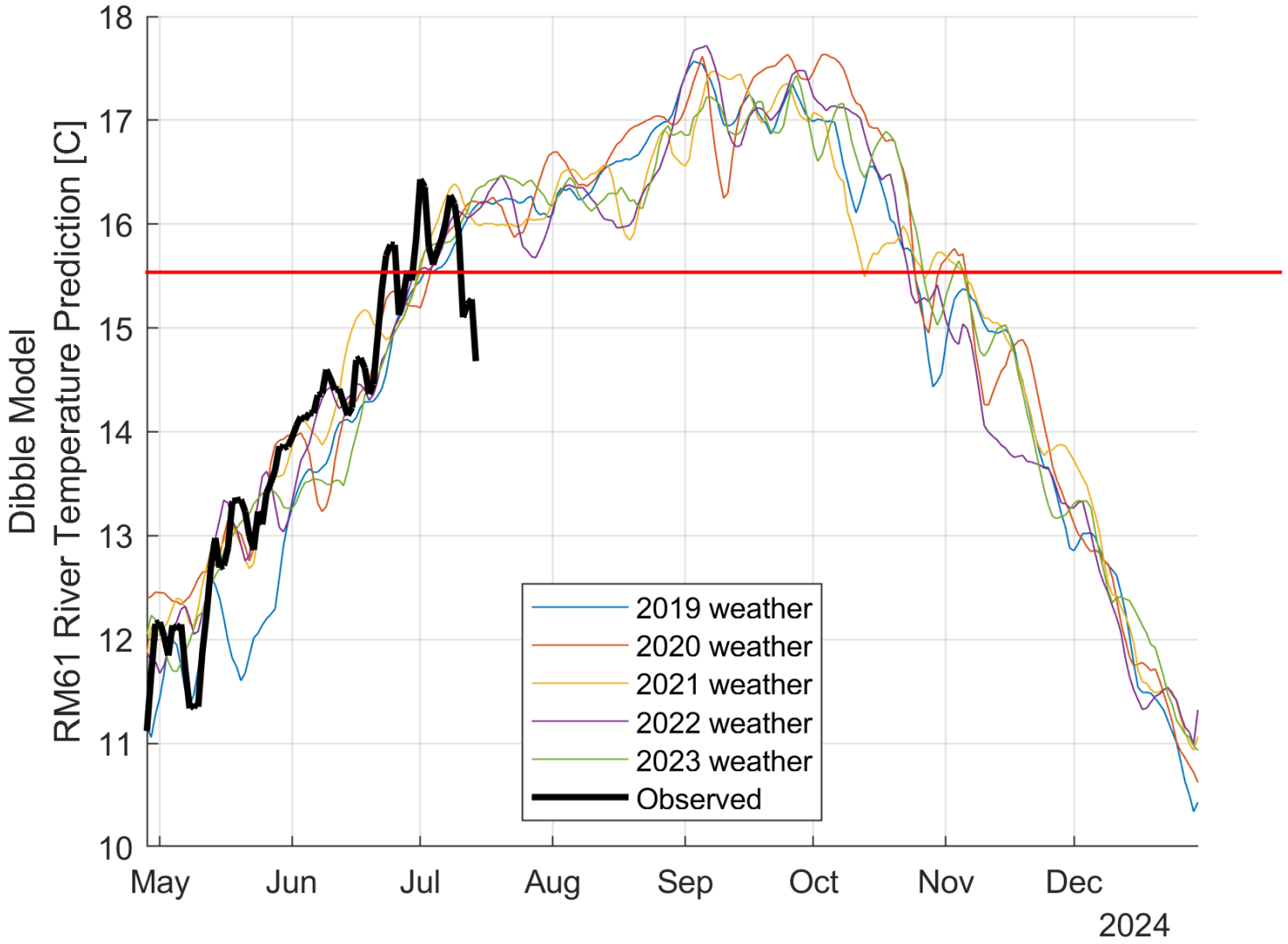
- Release Temperature
  - 90th Quantile Release Temps (Penstock)
  - Assumes Bypass Temp = 8.5 °C
- Release Volume
  - Planned Power and Bypass Volumes
- Weather
  - 14-Day NOAA GFS Air Temperatures
  - 14-Day NOAA GFS Solar Radiation



RM 61 River Temp Prediction – Dibble Model (Long – Term)

Model Inputs:

- Release Temperature
  - 90th Quantile Release Temps (Penstock)
- Release Volume
  - Planned Power volumes (no bypass)
- Weather
  - Past 5 Years Air Temperatures
  - Past 5 Years Solar Radiation




Questions?
BUREAU OF
RECLAMATION