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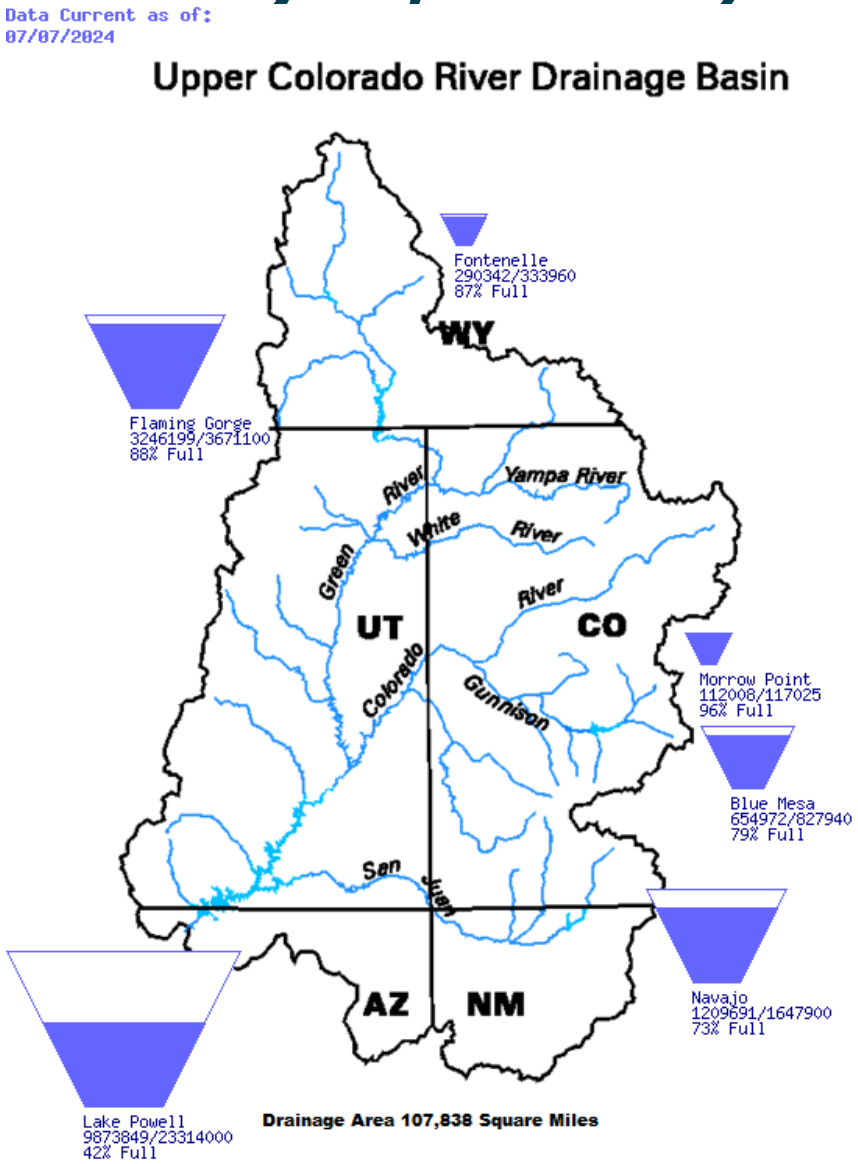
# Glen Canyon AMP Technical Working Group

## Basin Hydrology and Operations

July 9, 2024

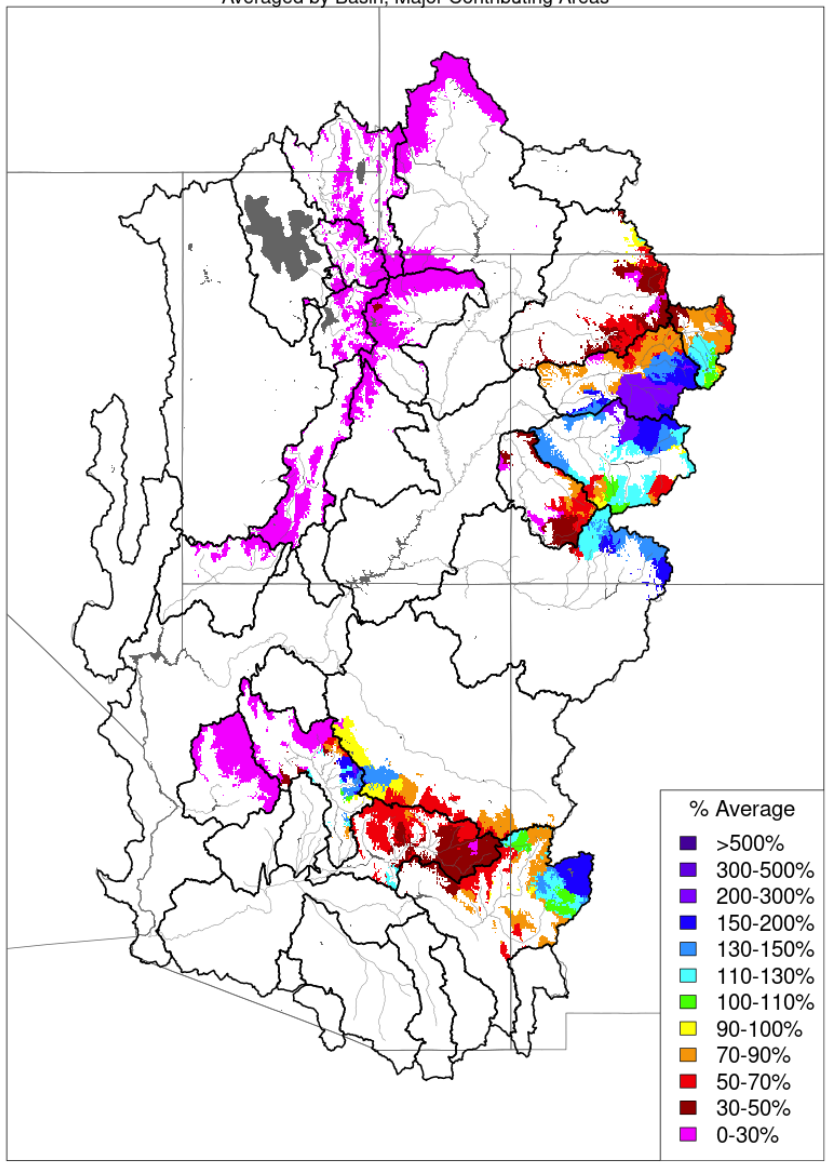
# Upper Basin Storage (as of July 8, 2024)

| Reservoir | Percent Current Live Storage | Current Live Storage (maf) | Live Storage Capacity (maf) | Elevation (feet) |
|---|---|---|---|---|
| Fontenelle | 87 | 0.29 | 0.33 | 6,500.28 |
| Flaming Gorge | 88 | 3.25 | 3.67 | 6,029.51 |
| Blue Mesa | 79 | 0.66 | 0.83 | 7,499.63 |
| Navajo | 73 | 1.21 | 1.65 | 6,053.22 |
| Lake Powell | 42 | 9.88 | 23.31 | 3,587.15 |
| UC System Storage | 51 | 15.41 | 29.79 | |
| Total System Storage | 45 | 26.31 | 58.48 | |



## Month to Date Precipitation - July 09 2024

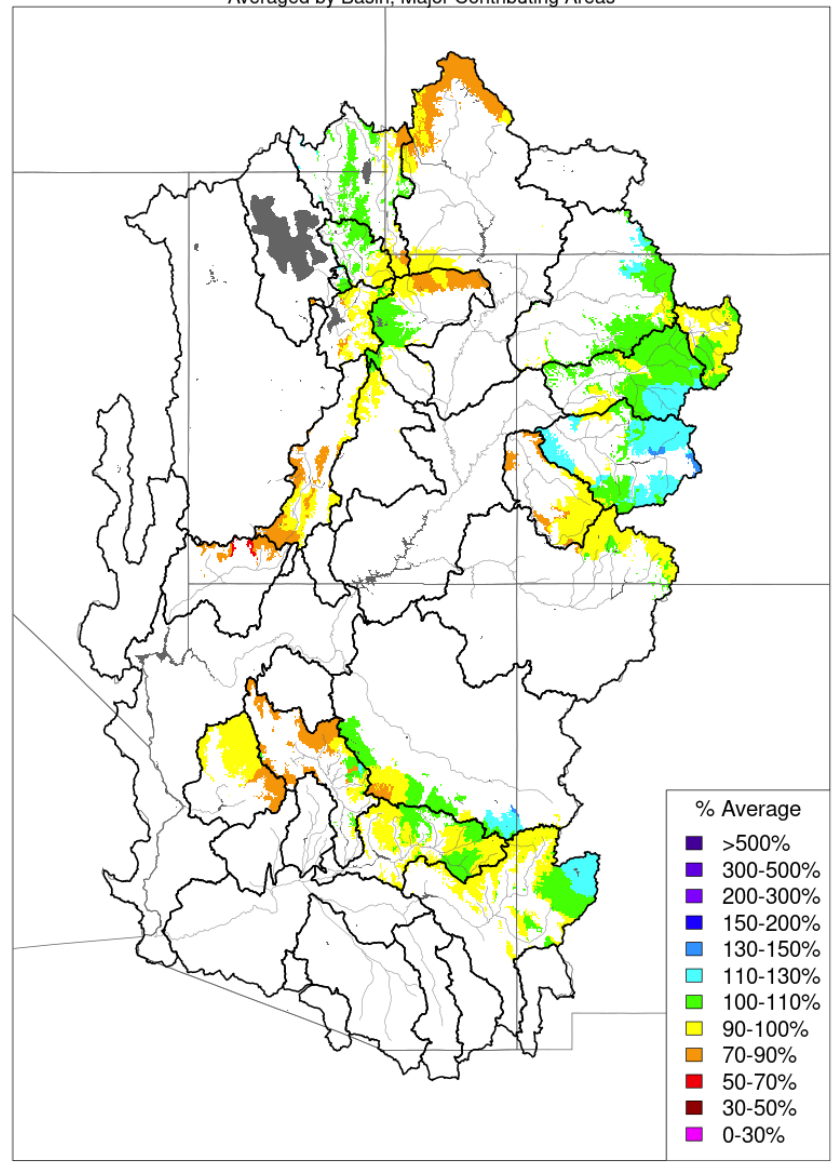
Averaged by Basin, Major Contributing Areas




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

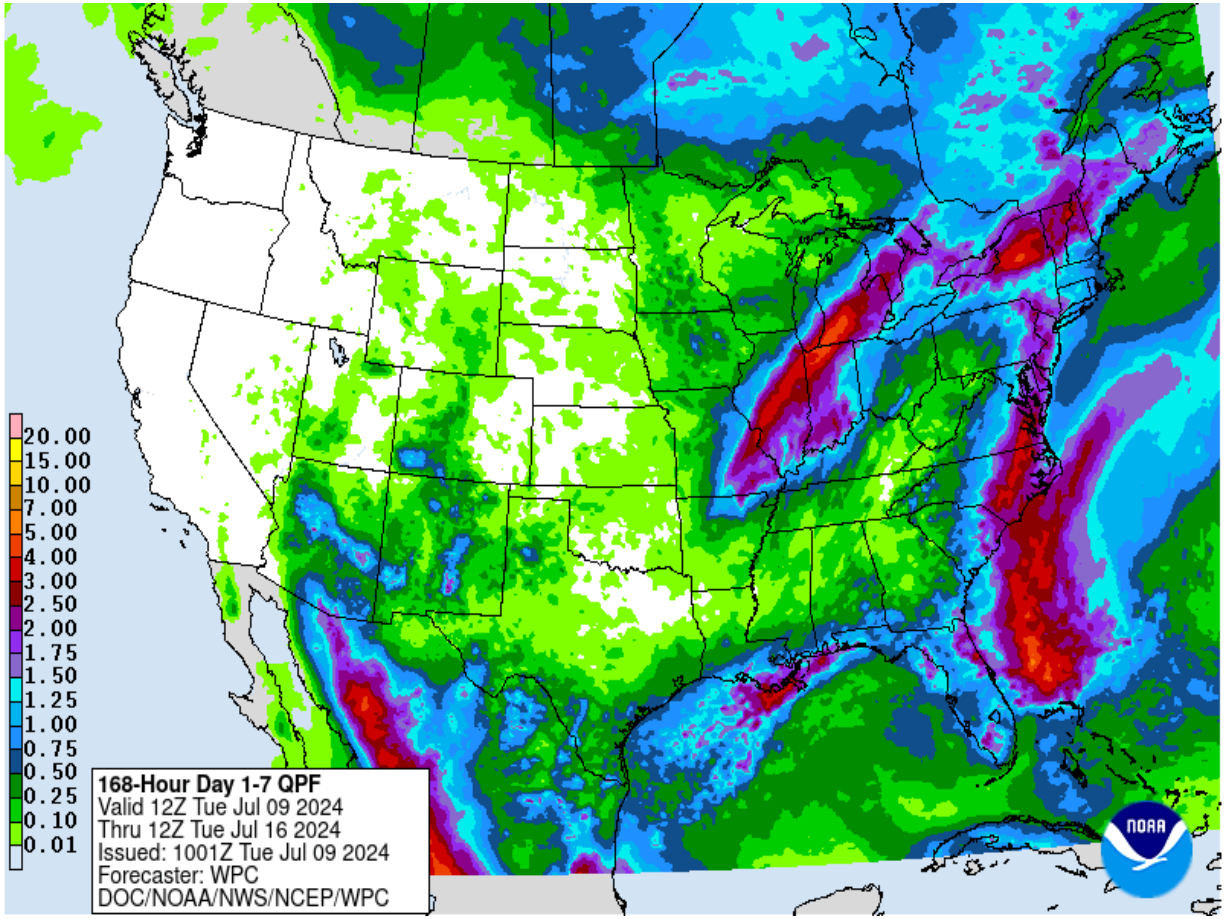
## Water Year to Date Precipitation, October 01 - July 09 2024

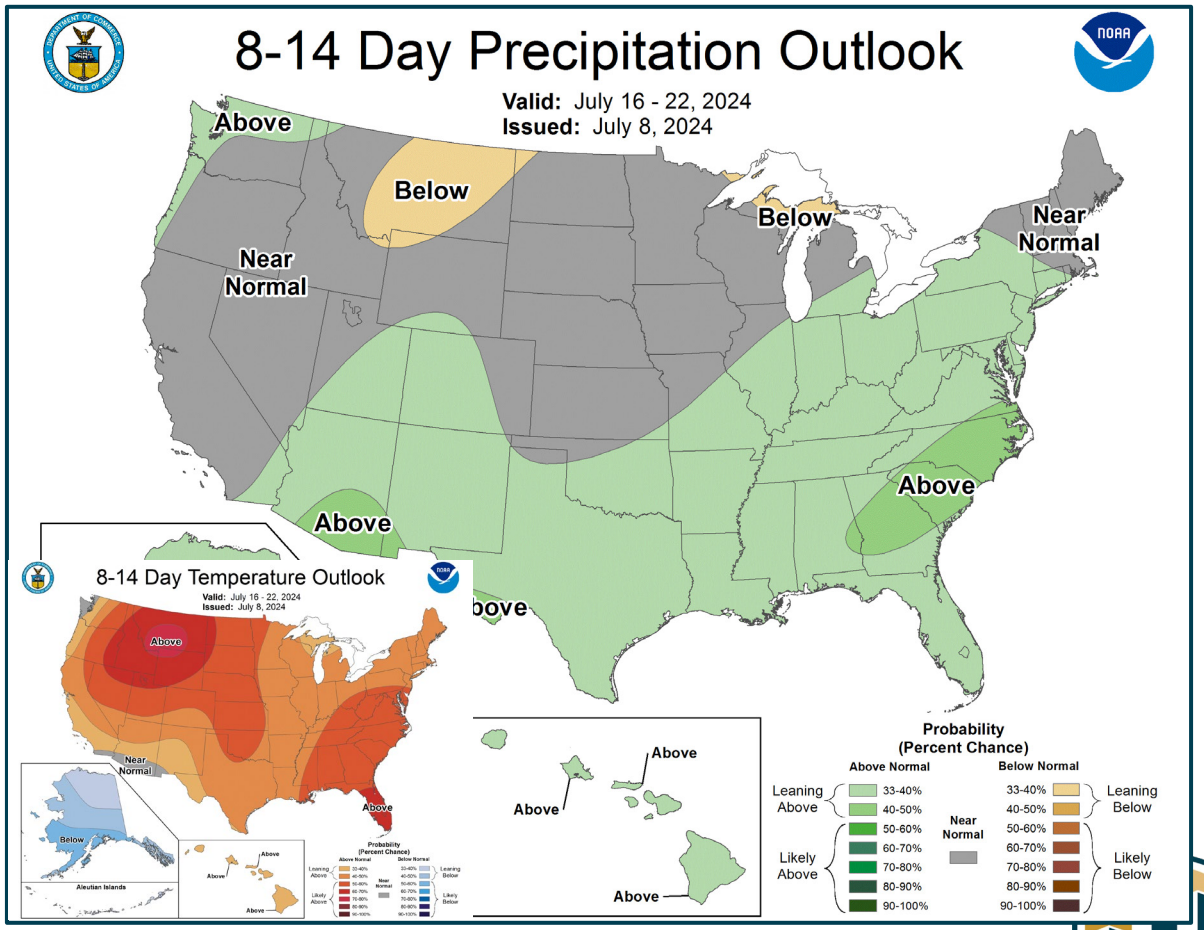
Averaged by Basin, Major Contributing Areas



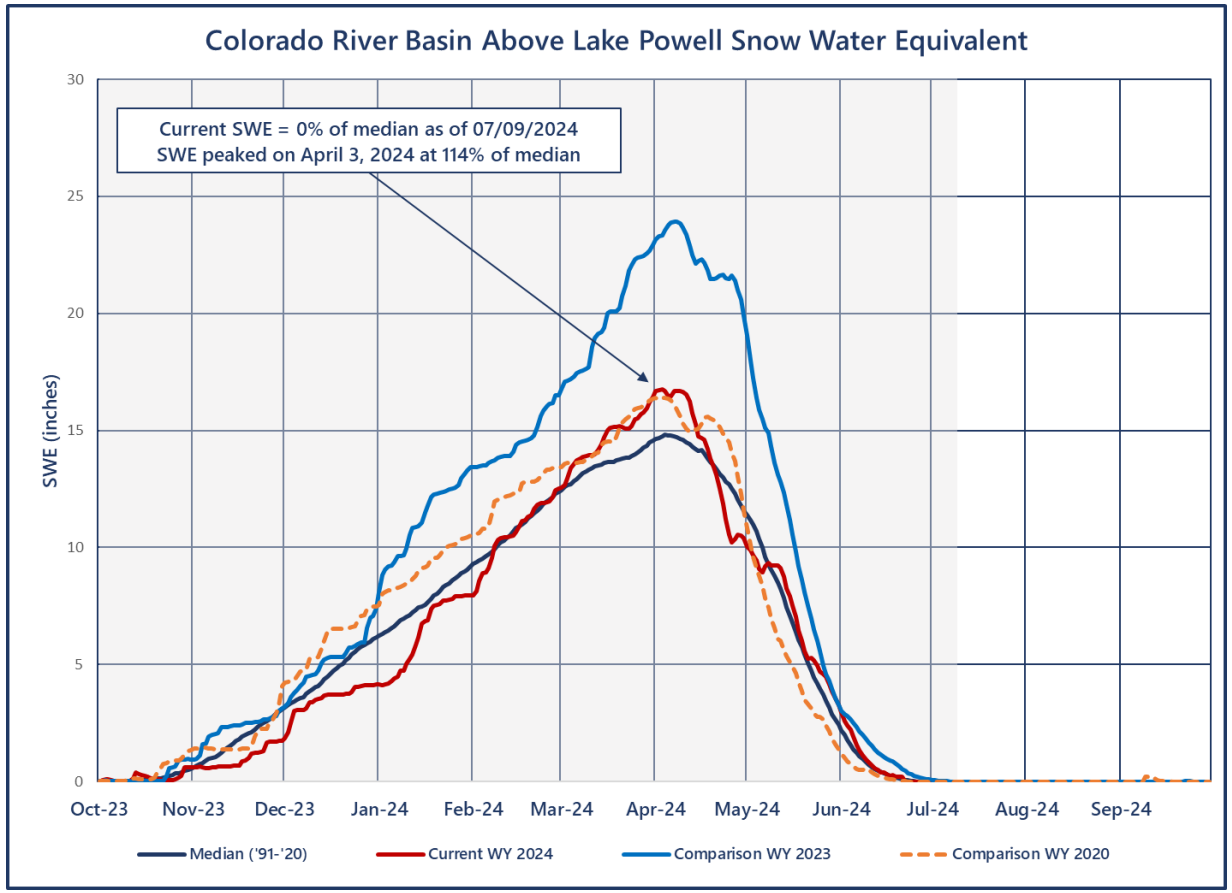

*Prepared by NOAA, Colorado Basin River Forecast Center*
*Salt Lake City, Utah, www.cbrfc.noaa.gov*

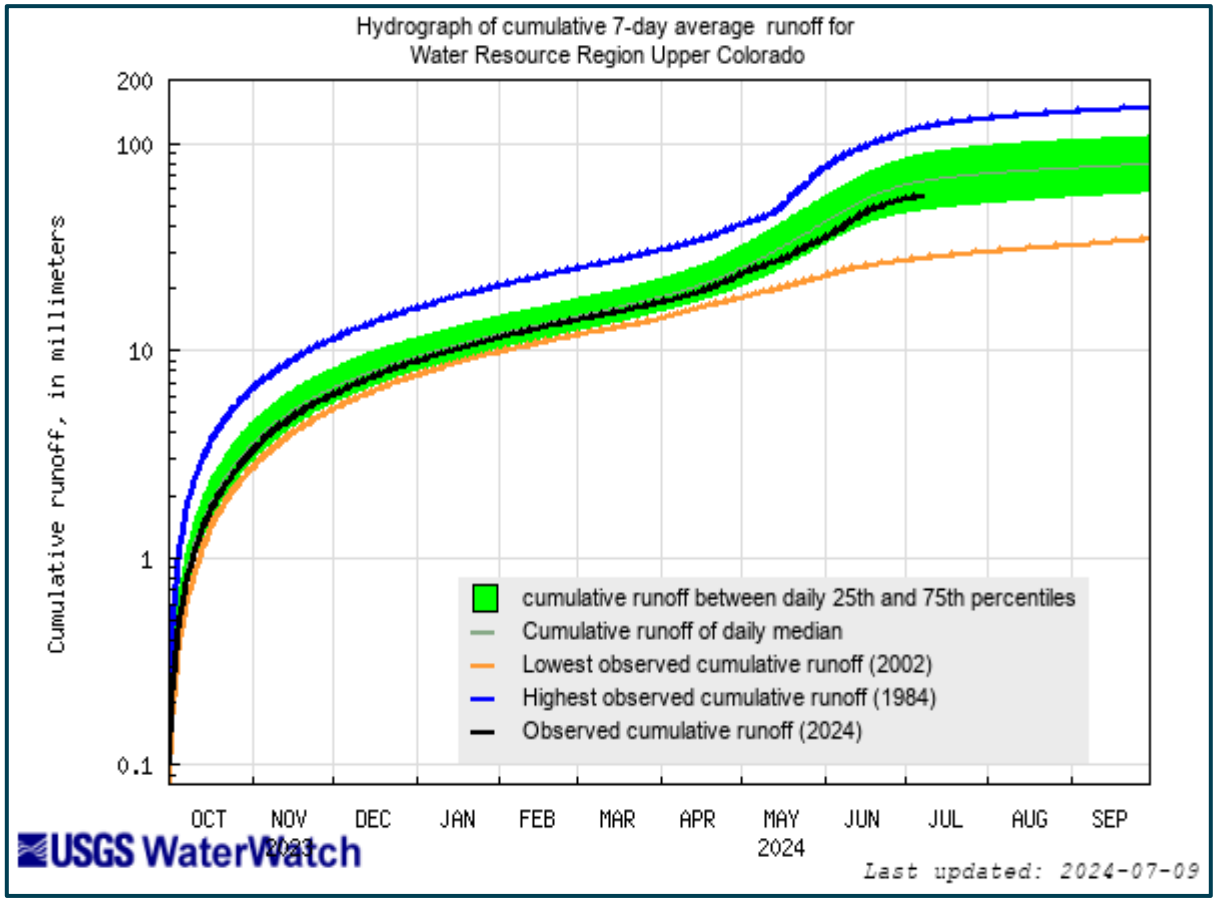
# Weather Prediction Center and Climate Prediction Center Precipitation Forecasts



# 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 |

## 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 |

[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 |

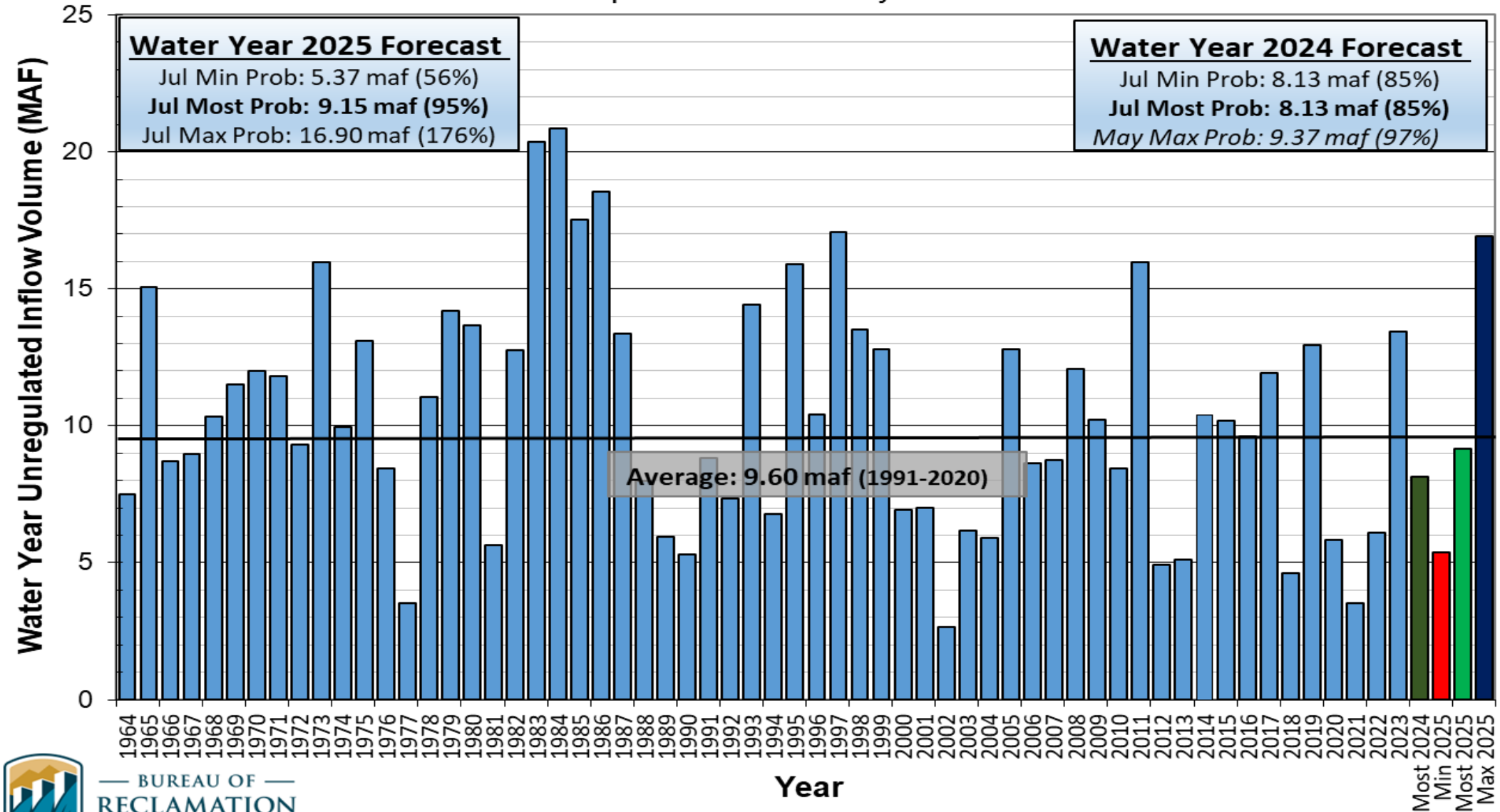
## Water Year 2025
## Unregulated Inflow Forecast

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

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# Upper Colorado Basin

## Hydrology and Operations Projections Based on May and June 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

# Most Probable June Forecast
# Water Year 2024

## April – July 2024
## Forecasted Unregulated Inflow

as of June 5, 2024

| Reservoir | Inflow (kaf) | Change from May | Percent of Avg[1] |
|---|---|---|---|
| Fontenelle | 544 | -55 | 74 |
| Flaming Gorge | 755 | -45 | 78 |
| Blue Mesa | 625 | +55 | 98 |
| Navajo | 420 | -20 | 67 |
| Powell | 5,100 | 0 | 80 |

June Midmonth = 5,200 kaf (81%)

## Water Year 2024
## Unregulated Inflow Forecast

as of June 5, 2024

| Reservoir | Inflow (kaf) | Change from May | Percent of Avg[1] |
|---|---|---|---|
| Fontenelle | 880 | -56 | 82 |
| Flaming Gorge | 1,230 | -44 | 87 |
| Blue Mesa | 878 | +66 | 97 |
| Navajo | 558 | -6 | 61 |
| Powell | 7,791 | -1 | 81 |

June Midmonth = 7,892 kaf (82%)

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

# Most Probable June Forecast
# Water Year 2025

## April – July 2025
## Forecasted Unregulated Inflow

as of June 5, 2024

| Reservoir | Inflow (kaf) | Percent of Avg[1] |
|---|---|---|
| Fontenelle | 660 | 90 |
| Flaming Gorge | 855 | 88 |
| Blue Mesa | 621 | 98 |
| Navajo | 618 | 98 |
| Powell | 6,060 | 95 |

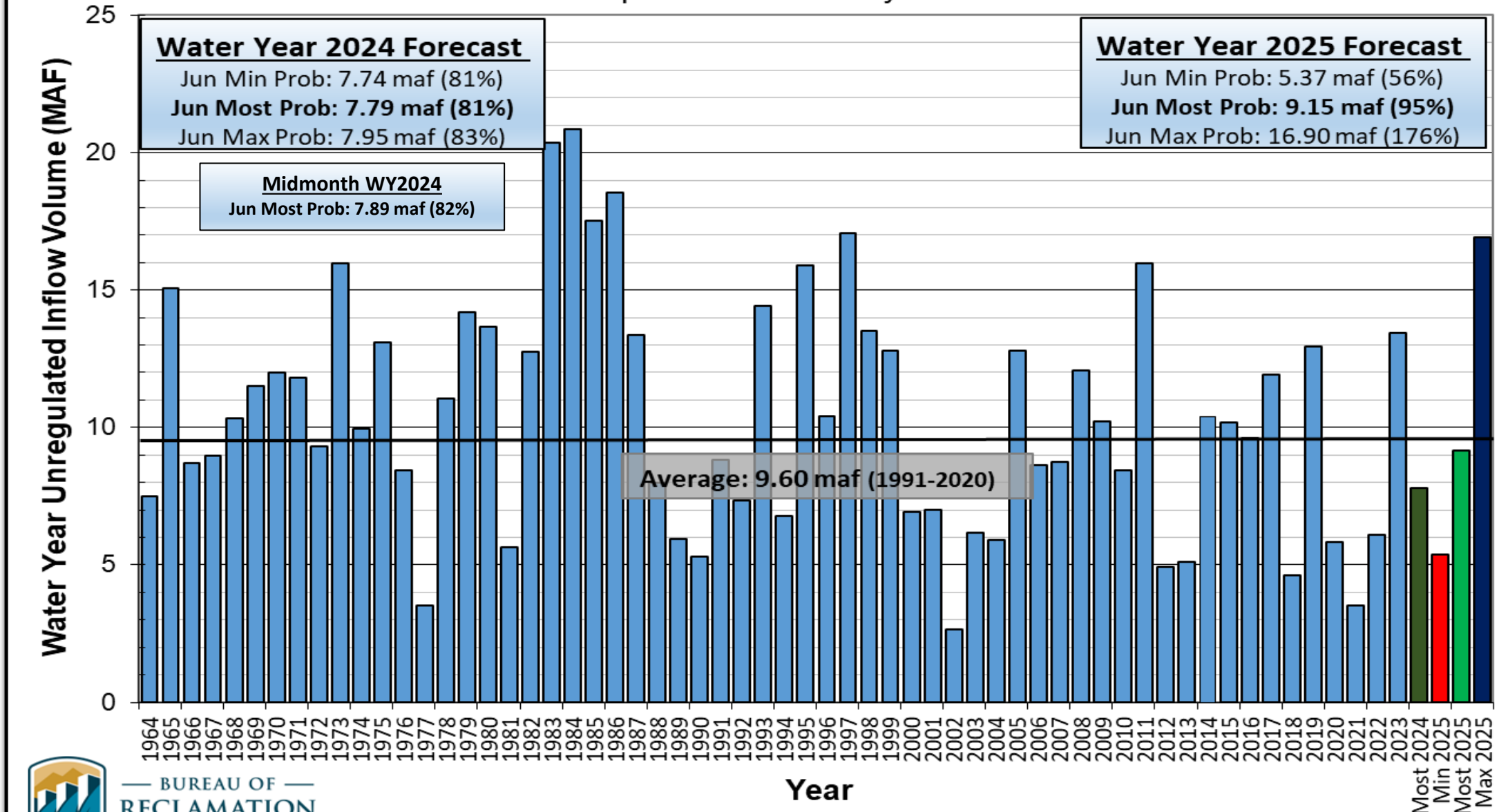
## Water Year 2025
## Unregulated Inflow Forecast

as of June 5, 2024

| Reservoir | Inflow (kaf) | Percent of Avg[1] |
|---|---|---|
| Fontenelle | 970 | 90 |
| Flaming Gorge | 1,275 | 88 |
| Blue Mesa | 885 | 93 |
| Navajo | 904 | 99 |
| 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 Jun 5)*
Comparison with History

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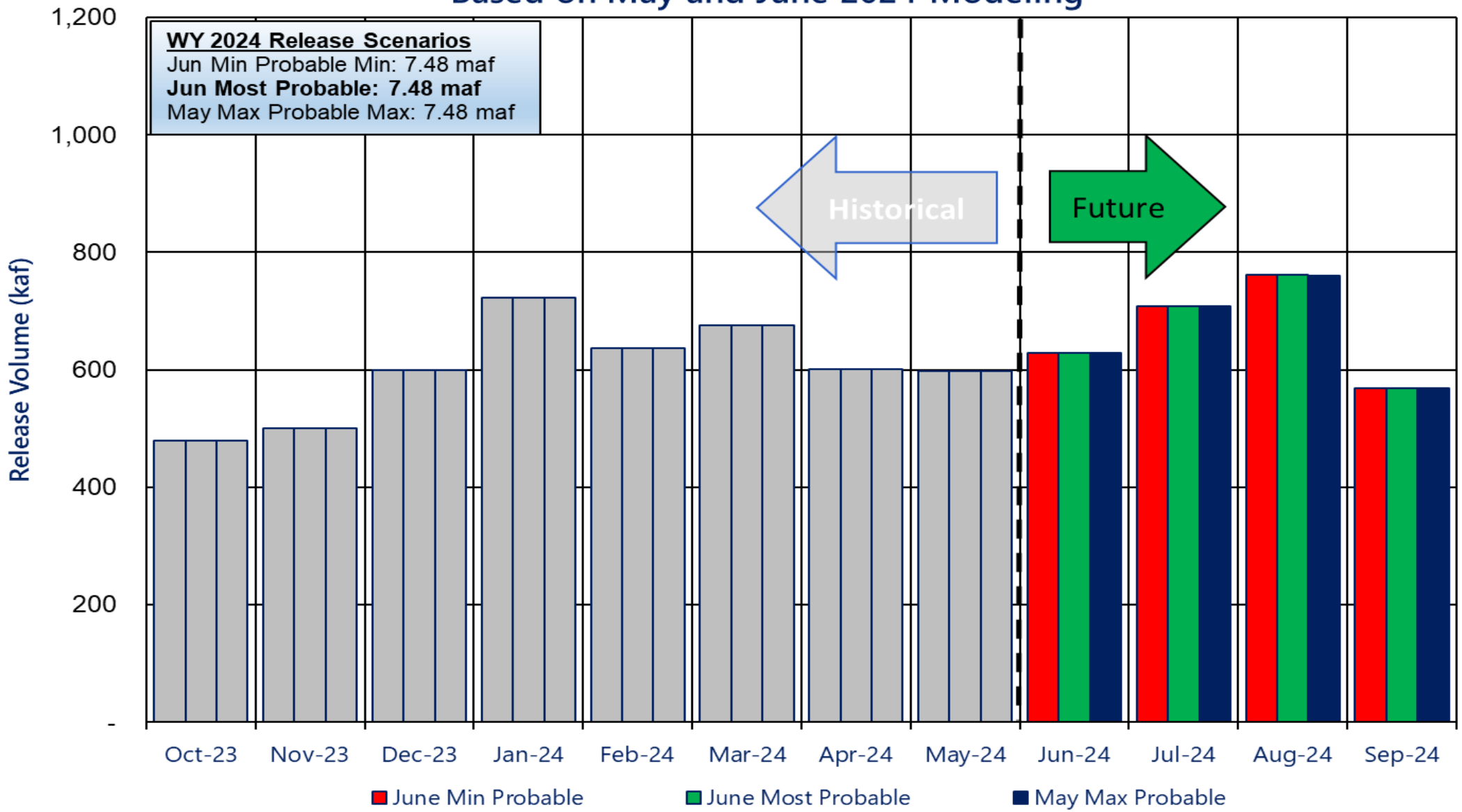
# Potential Lake Powell Monthly Release Volume Distribution

## Release Scenarios for Water Year 2024

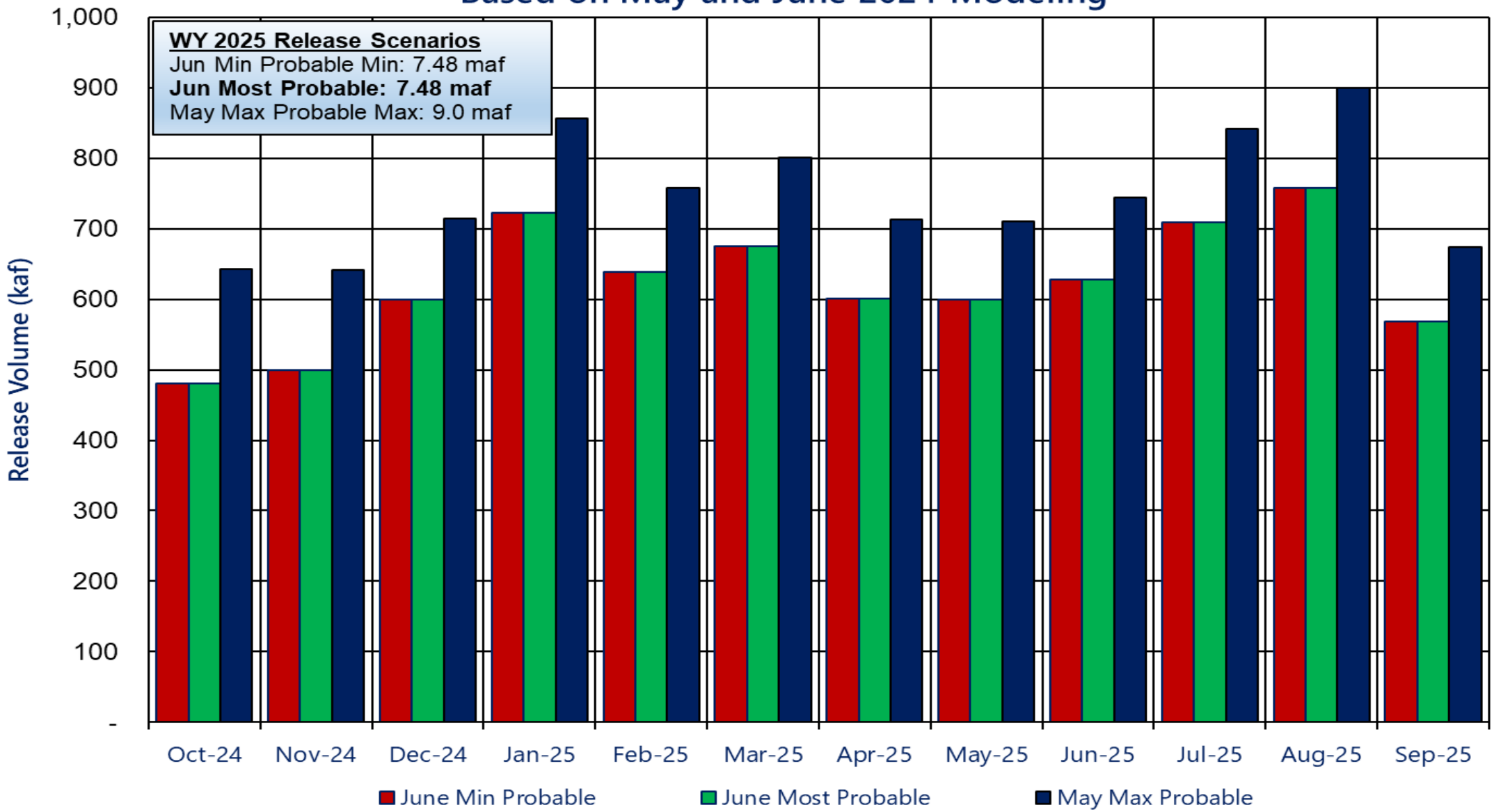
## Based on May and June 2024 Modeling



# Potential Lake Powell Monthly Release Volume Distribution

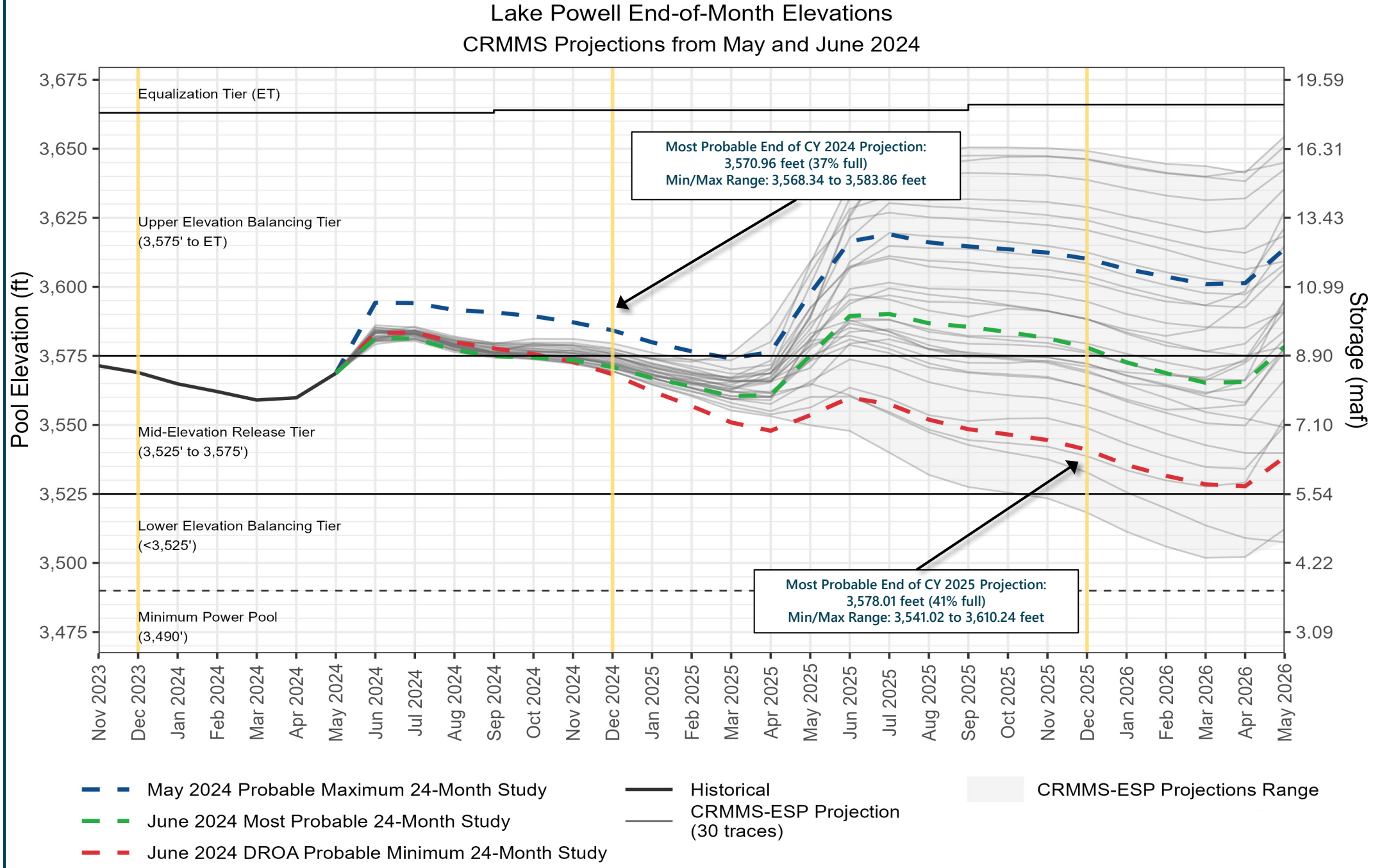
## Release Scenarios for Water Year 2025

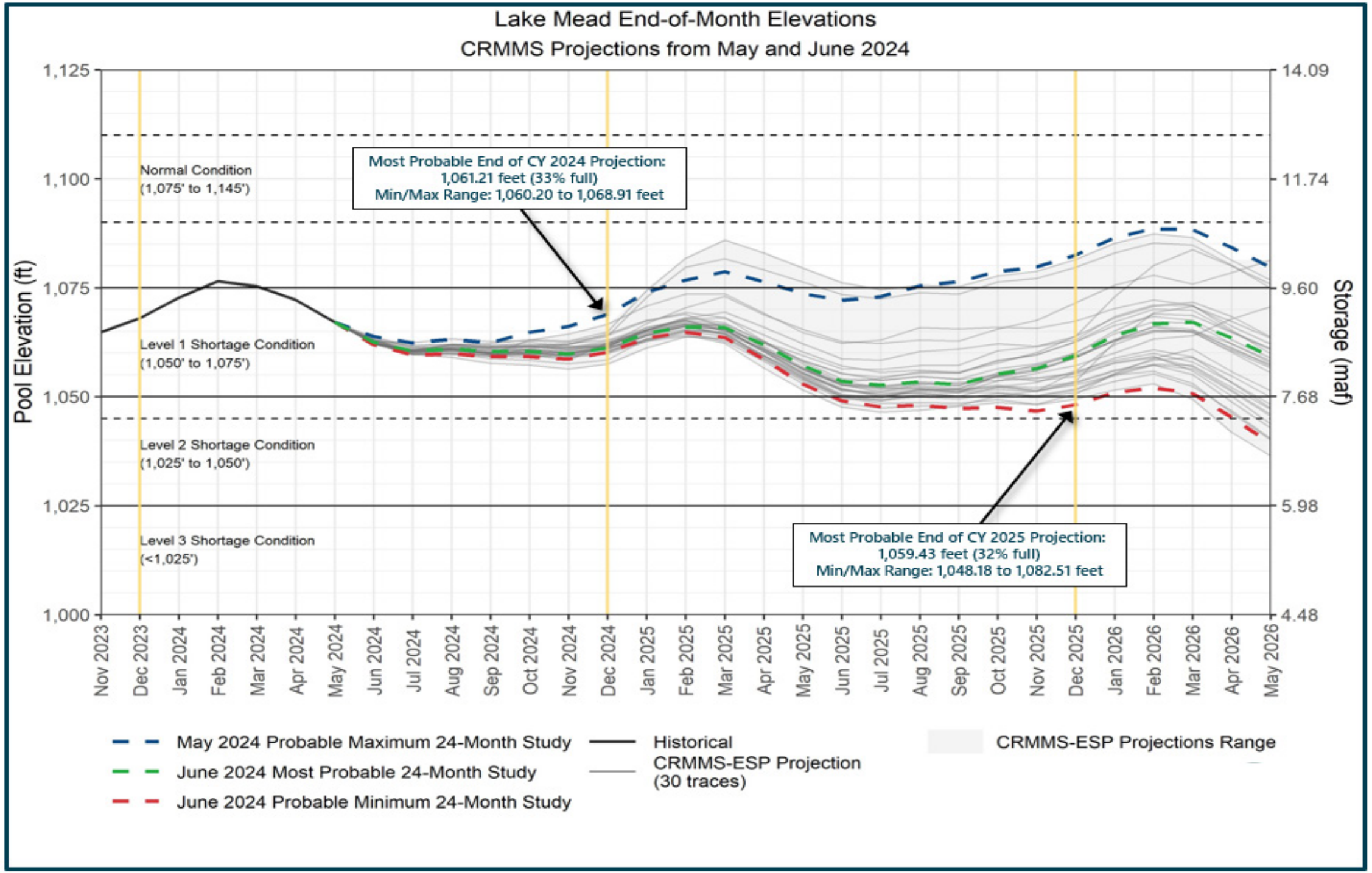
## Based on May and June 2024 Modeling



# 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 June 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:
3,570.96 feet (37% full)
Min/Max Range: 3,568.34 to 3,583.86 feet
Most Probable End of CY 2025 Projection:
3,578.01 feet (41% full)
Min/Max Range: 3,541.02 to 3,610.24 feet
Nov 2023
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
May 2024 Probable Maximum 24-Month Study
June 2024 Most Probable 24-Month Study
June 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 June 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:
1,061.21 feet (33% full)
Min/Max Range: 1,060.20 to 1,068.91 feet
Most Probable End of CY 2025 Projection:
1,059.43 feet (32% full)
Min/Max Range: 1,048.18 to 1,082.51 feet
Nov 2023
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
May 2024 Probable Maximum 24-Month Study
June 2024 Most Probable 24-Month Study
June 2024 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

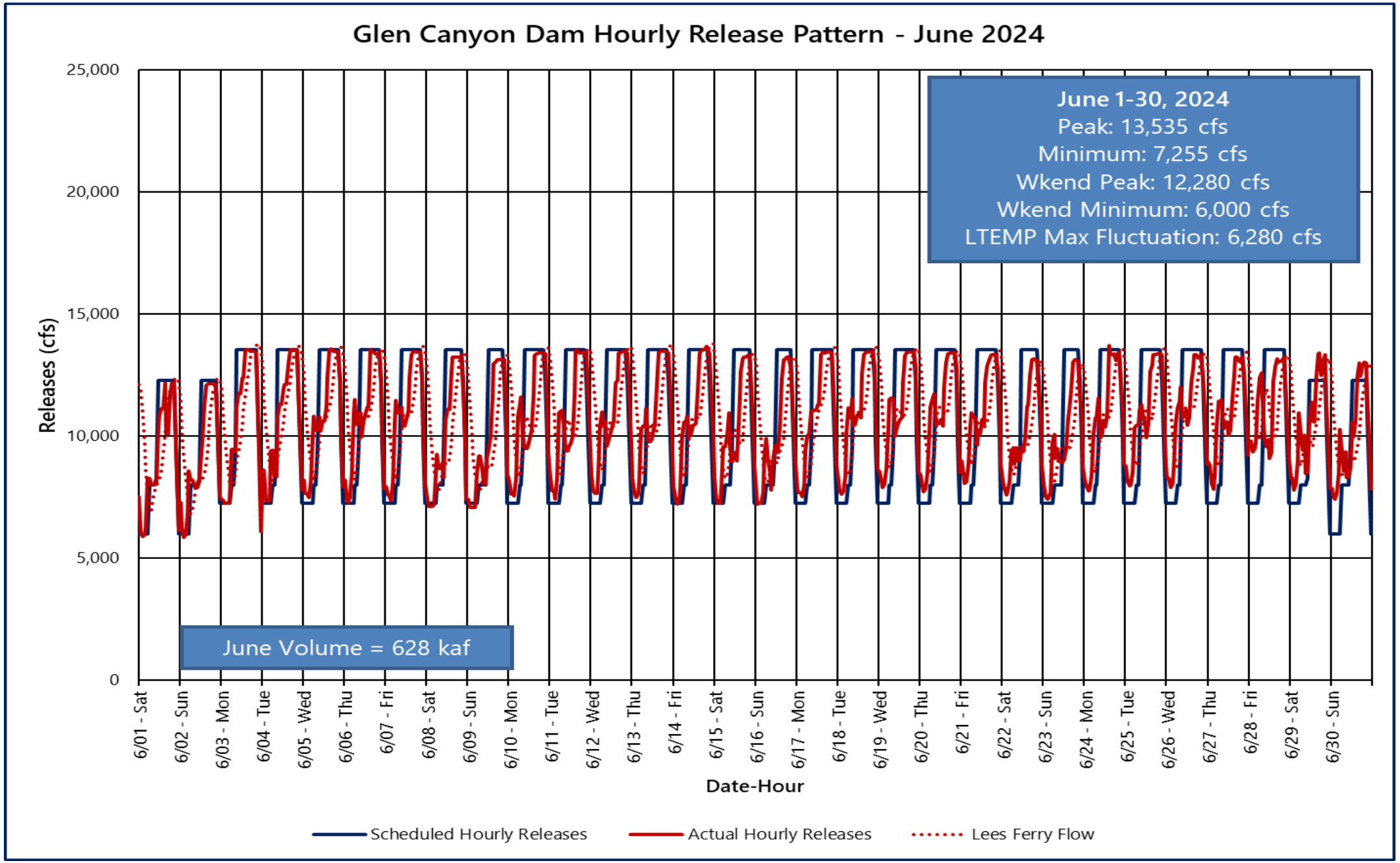
| Unit Number | Oct 2023 | Nov 2023 | Dec 2023 | Jan 2024 | Feb 2024 | Mar 2024 | Apr 2024 | May 2024 | Jun 2024 | Jul 2024 | Aug 2024 | Sep 2024 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 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 | |
| Capacity (cfs) | 12,400 | 19,450 | 19,400 | 19,300 | 19,200 | 19,100 | 19,100 | 16,000 | 27,000 | 27,000 | 23,200[3] | 19,600 | JUN MOST[2] |
| Capacity (kaf/month) | 770 | 1,030 | 1,190 | 1,190 | 1,100 | 1,220 | 1,280 | 1,030 | 1,600 | 1,660 | 1,560 | 1,310 | JUN 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 06-18-2024) | | | |

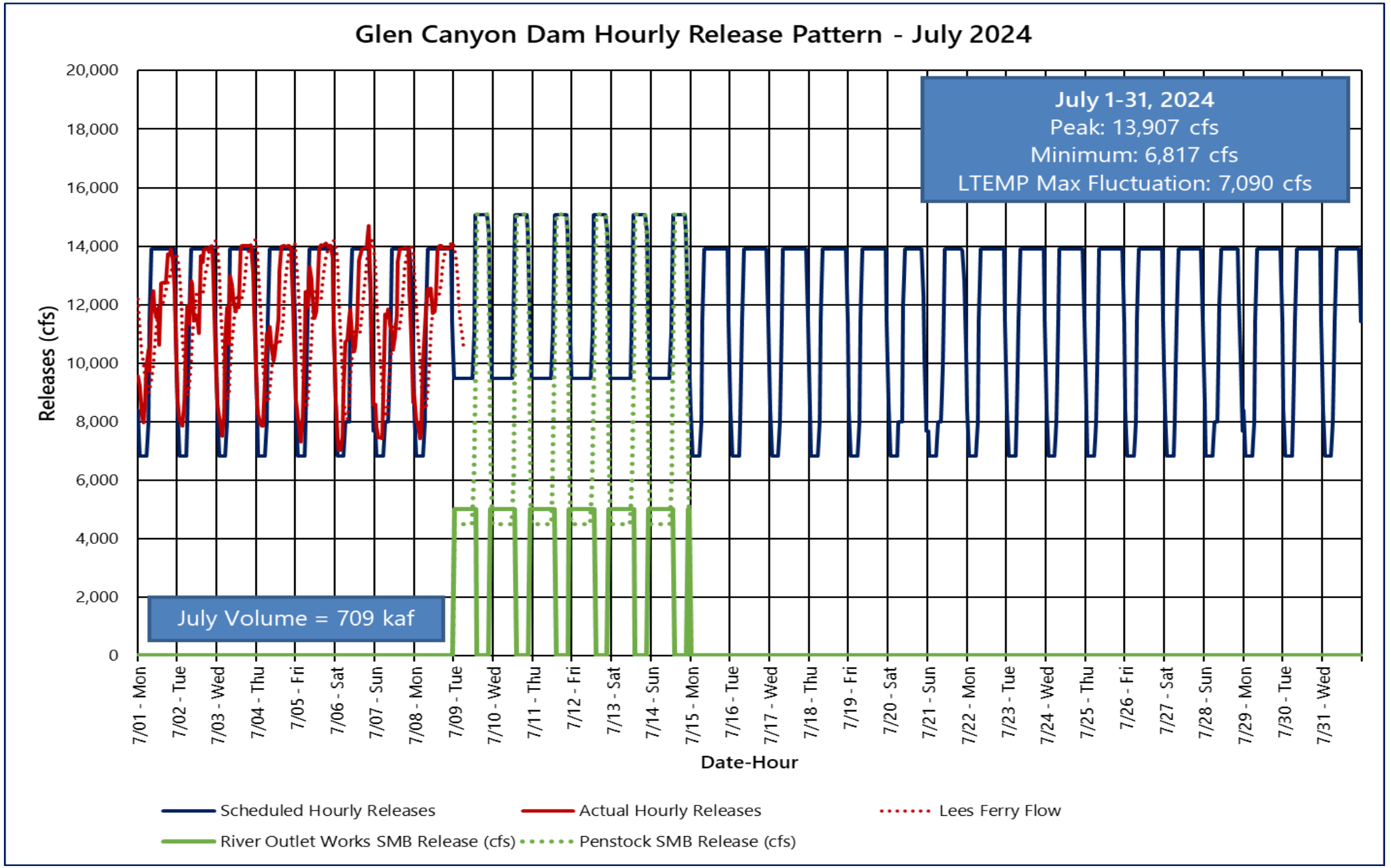
1 Projected release, based on June 2024 24MS for the minimum and most probable and the May 2024 24MS maximum probable 24-Month Study model runs.
2 Dependent upon availability to shift contingency regulation, which will increase capacity by 30-40MW (3%) at current efficiency.
3 NERC testing with occasional 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 | |
| Capacity (cfs) | 16,000/ 4,000[3] | 19,600 | 26,800 | 19,600 | 19,600 | 19,600 | 23,150 | 23,150 | 26,800 | 26,800 | 26,800 | 19,600 | JUN MOST[2] |
| Capacity (kaf/month) | 1,200 | 1,490 | 1,640 | 1,570 | 1,000 | 1,230 | 1,380 | 1,590 | 1,590 | 1,640 | 1,640 | 1,180 | JUN 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 06-18-2024) | | | |

1 Projected release, based on June 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)


Questions?
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