BUREAU OF RECLAMATION

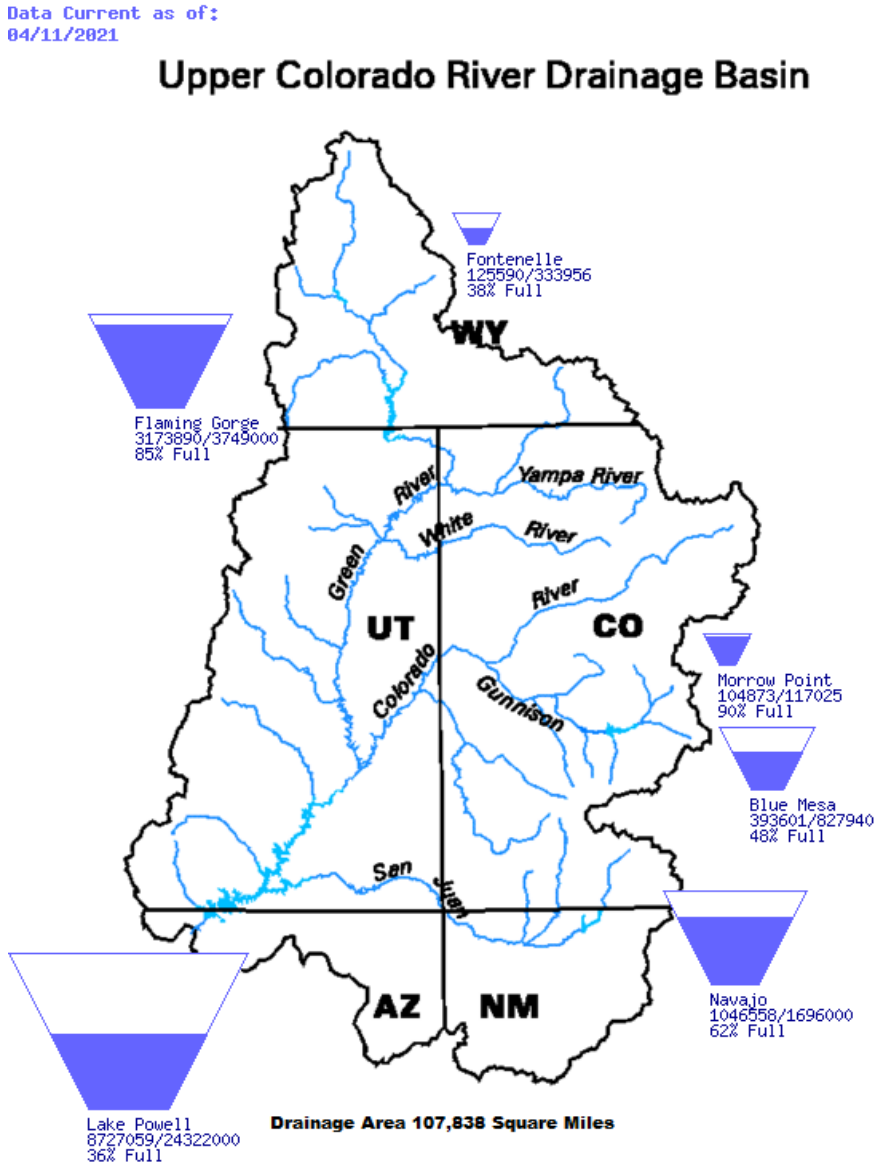
Update on Hydrology, Operations and Water Quality Conditions

GCAMP Technical Working Group

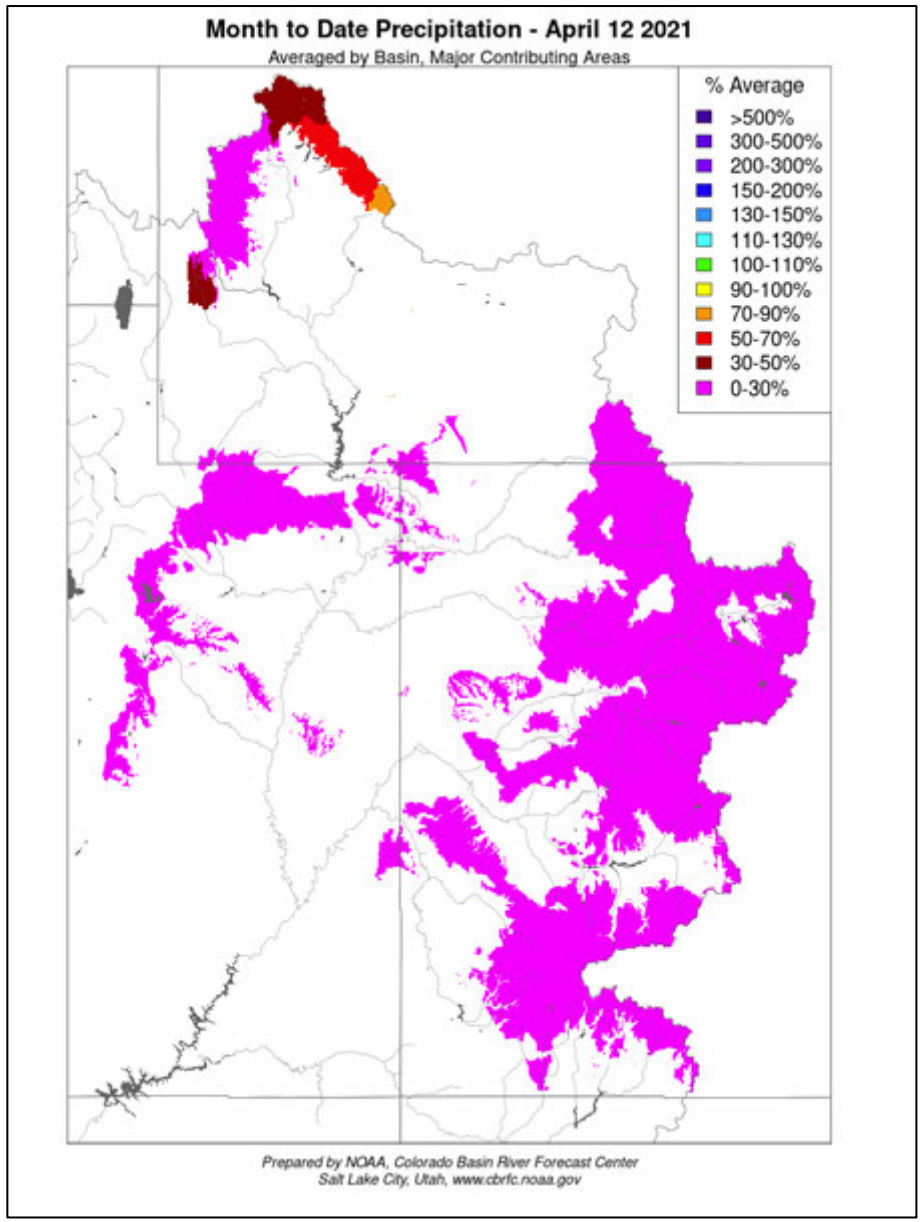
April 13, 2021

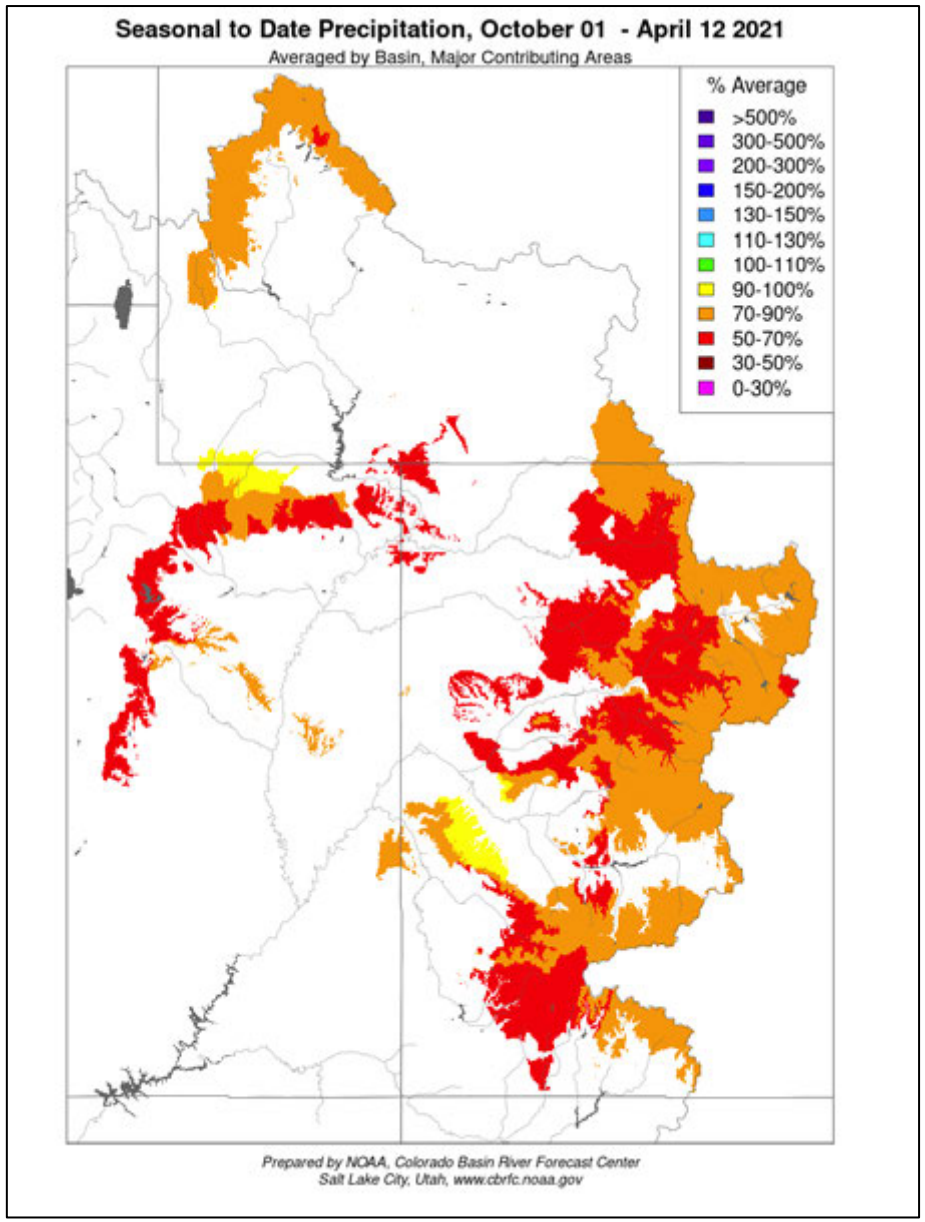
Upper Basin Storage (as of April 11, 2021)

Reservoir	Percent Current Live Storage	Current Live Storage (maf)	Live Storage Capacity (maf)	Elevation (feet)
Fontenelle	38	0.13	0.33	6473.12
Flaming Gorge	85	3.17	3.75	6,025.37
Blue Mesa	48	0.39	0.83	7,464.23
Navajo	62	1.05	1.70	6,033.73
Lake Powell	36	8.73	24.32	3,565.23
UC System Storage	44	13.59	31.09	

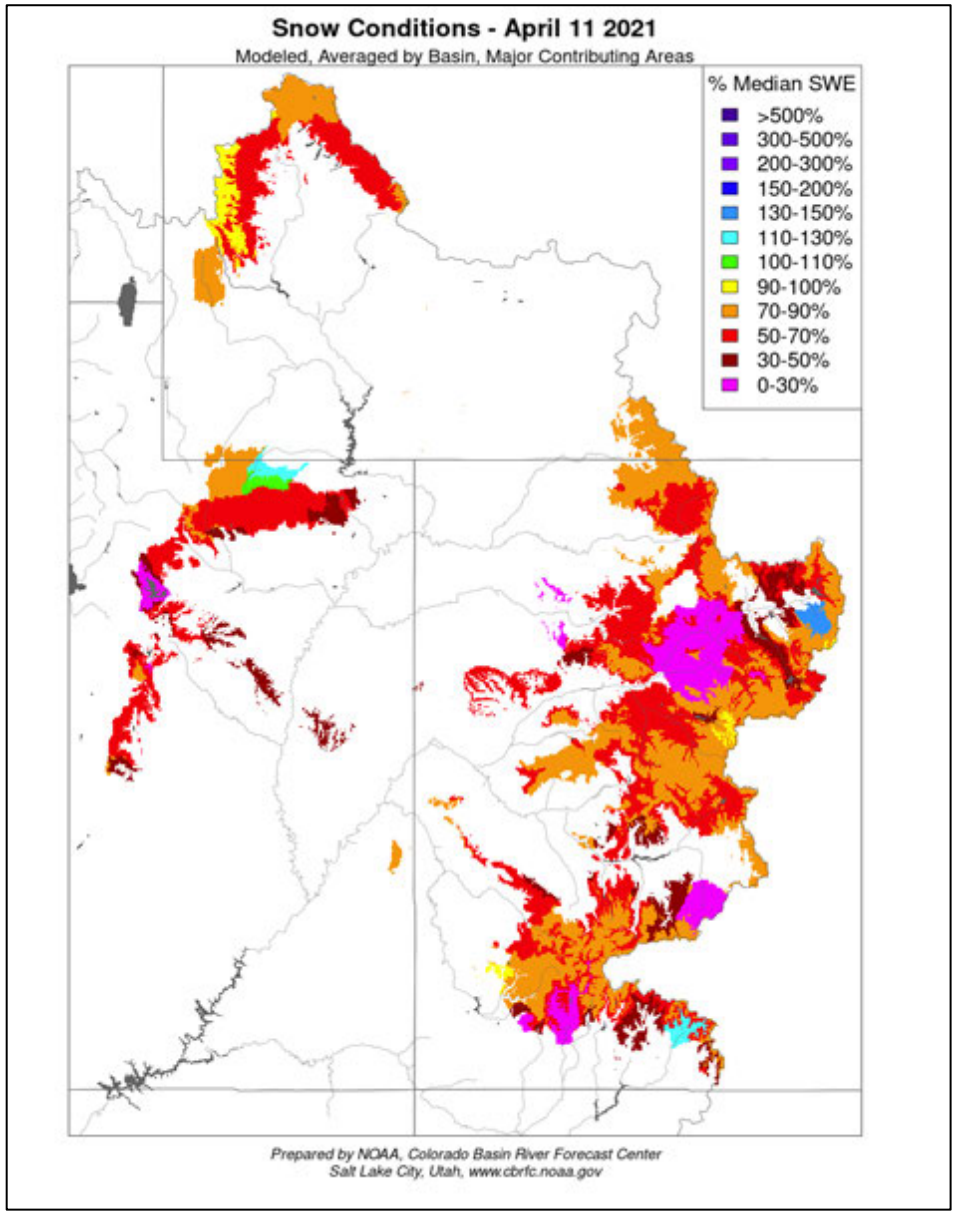


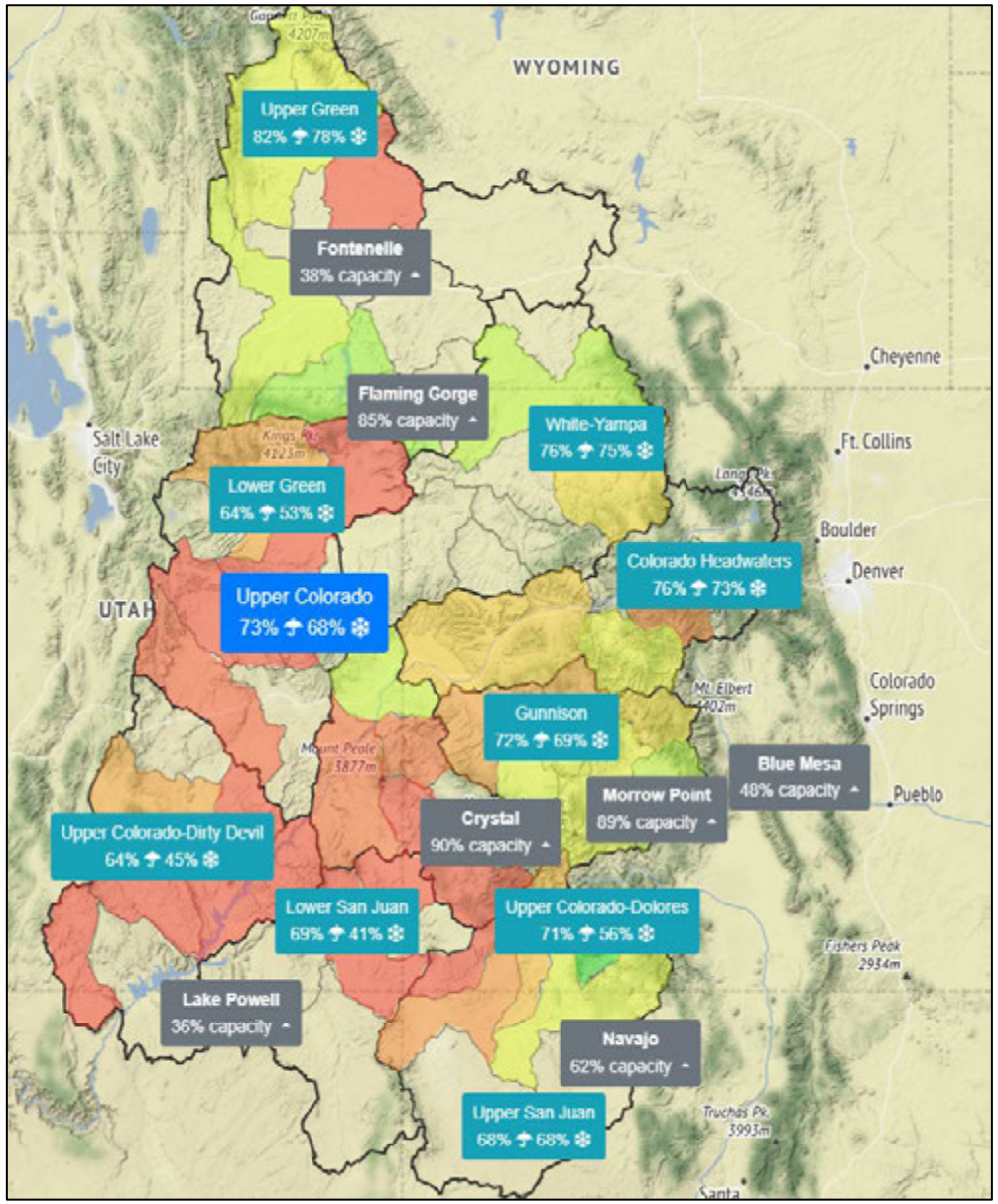
Seasonal and Monthly Precipitation



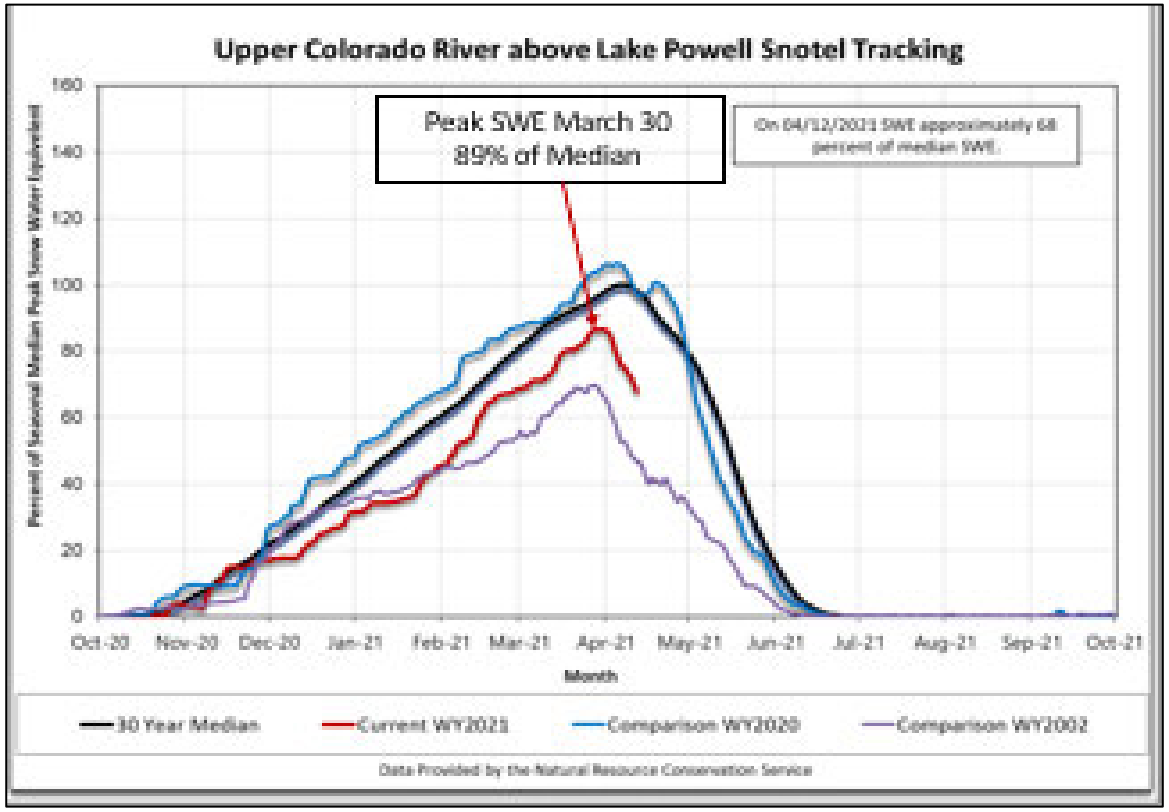


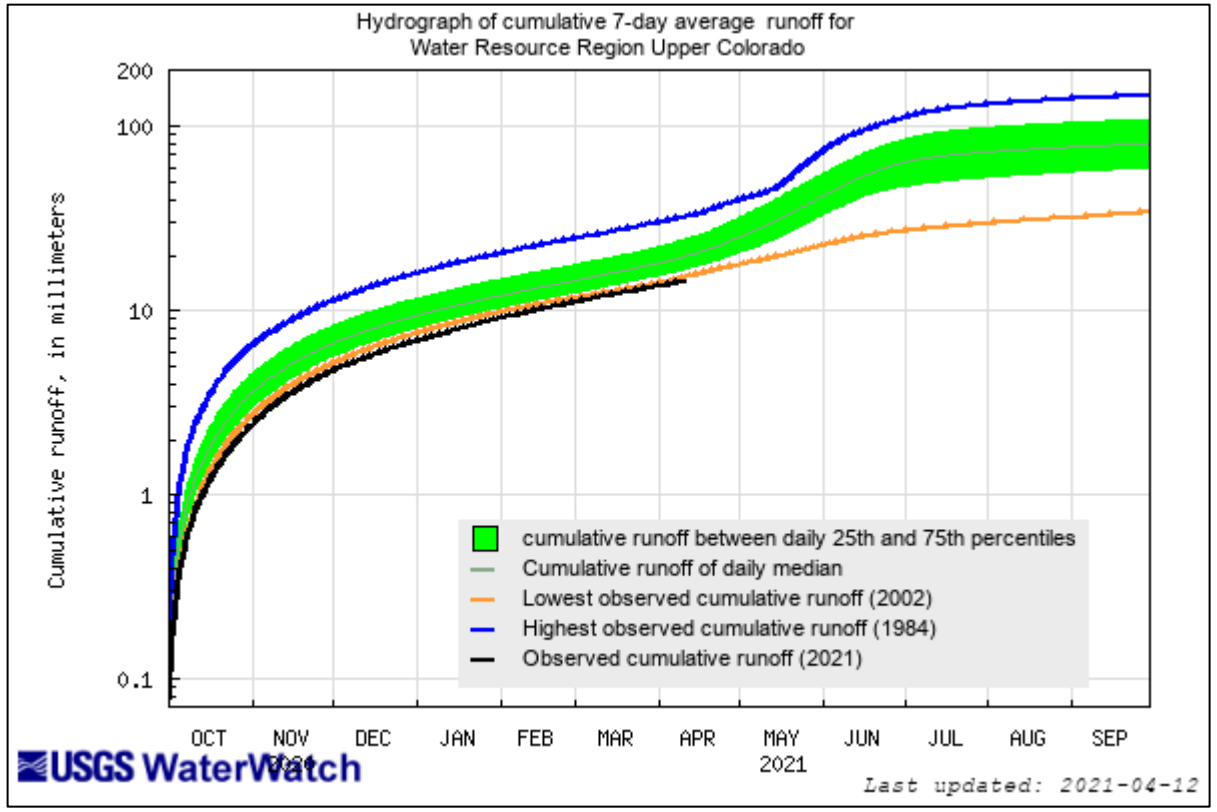
Seasonal Snow Conditions and Basin SWE





Current Snow Water Equivalent (as of April 11, 2021)





Most Probable Spring and WY2021 Forecast

April – July 2021 Forecasted Unregulated Inflow

as of April 2, 2021

Reservoir	Unregulated Inflow (kaf)	Percent of Average[1]
Fontenelle	430	59
Flaming Gorge	430	54
Blue Mesa	440	65
Navajo	395	54
Powell	3,200	45

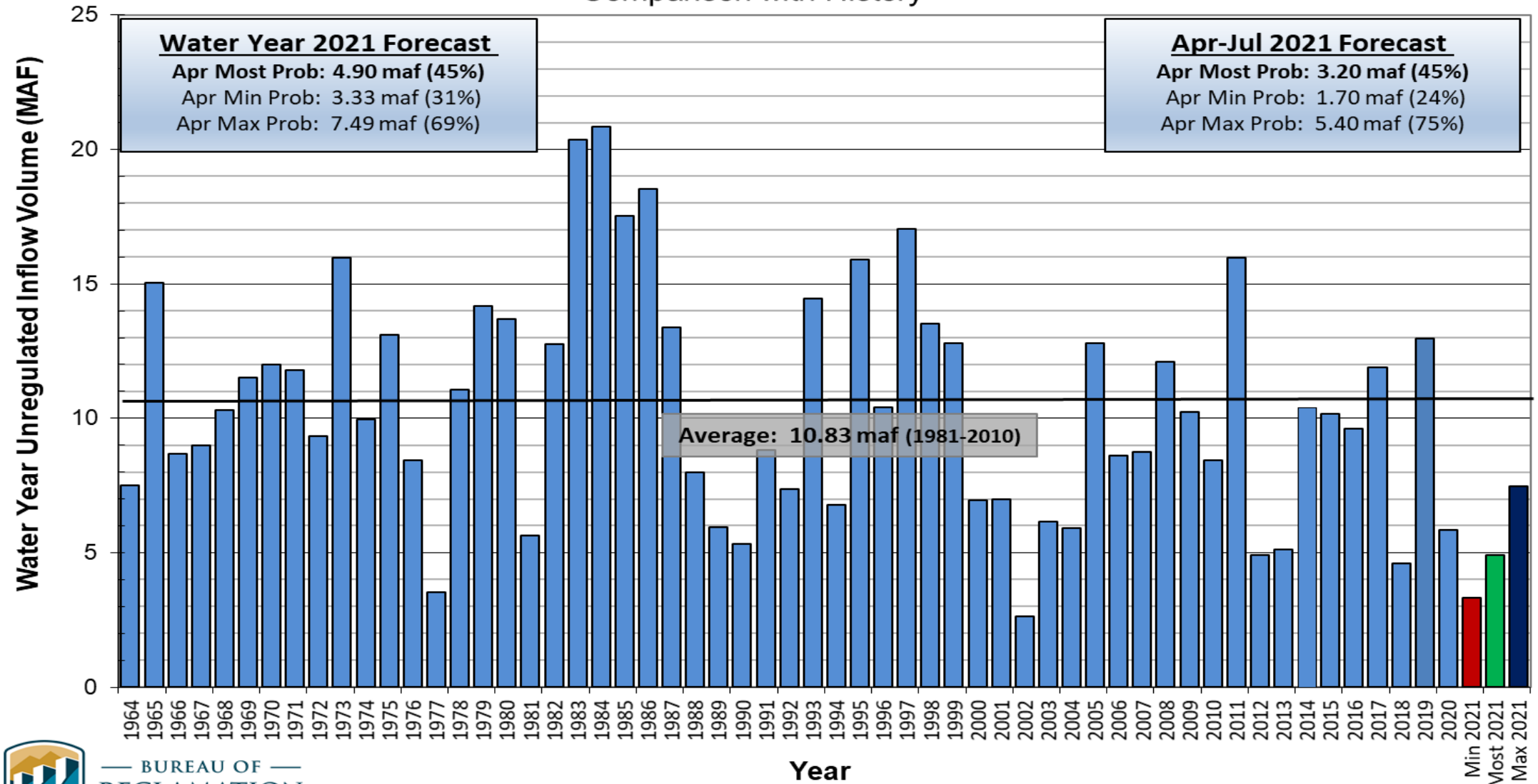
Water Year 2021 Forecasted Unregulated Inflow

as of April 5, 2021

Reservoir	Unregulated Inflow (kaf)	Percent of Average[1]
Fontenelle	691	64
Flaming Gorge	833	57
Blue Mesa	645	68
Navajo	538	50
Powell	4,897	45

[1] Percent of average based on the period of record from 1981-2010.

Lake Powell Unregulated Inflow
Water Year 2021 Forecast *(issued April 2)*
Comparison with History



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Upper Colorado Basin

Projected Operations for Water Year 2021 Based on March 2021 Modeling

March Most Probable Spring and WY2021 Forecast

April – July 2021 Forecasted Unregulated Inflow

as of March 2, 2021

Reservoir	Unregulated Inflow (kaf)	Percent of Average[1]
Fontenelle	480	66
Flaming Gorge	555	57
Blue Mesa	460	68
Navajo	415	56
Powell	3,400	47

Water Year 2021 Forecasted Unregulated Inflow

as of March 2, 2021

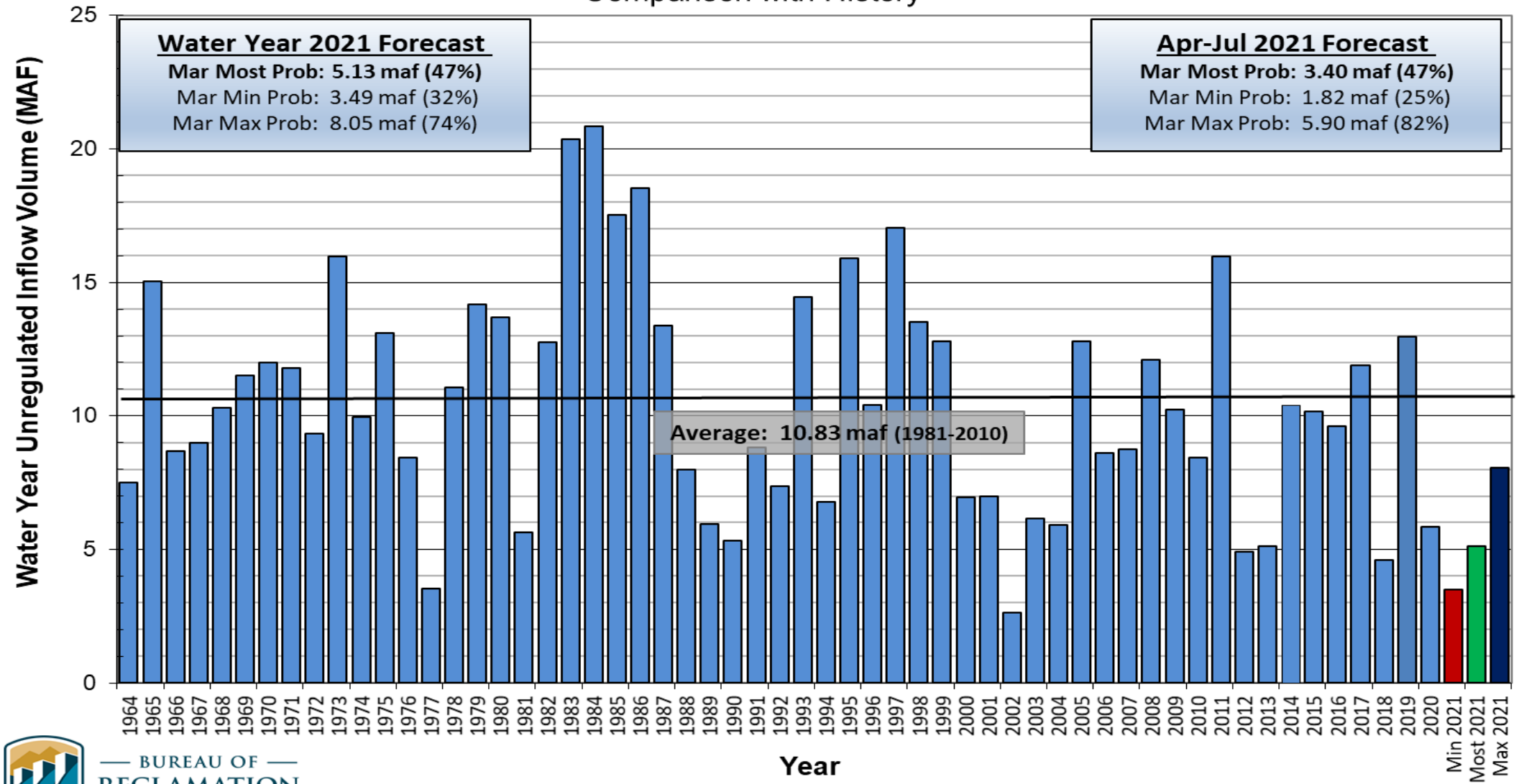
Reservoir	Unregulated Inflow (kaf)	Percent of Average[1]
Fontenelle	755	70
Flaming Gorge	865	59
Blue Mesa	669	70
Navajo	567	53
Powell	5,130	47

[1] *Percent of average based on the period of record from 1981-2010.*

Drought Response Operations Agreement (DROA)

- Formal notification that the January 2021 Minimum Probable 24 Month Study (24-MS) run projected Powell to fall below 3,525 feet in 2022 was provided pursuant to the DROA.
  - February and March Minimum Probable 24-MS continued to indicate elevations below 3525 feet in 2022.
- These minimum projections *do not* initiate immediate operational changes to Reclamation facilities.
- These minimum projections *do* initiate enhanced monitoring and coordination under the DROA.
- These minimum projections *do* initiate monthly analysis of min/most/max with the parties specified in the DROA.
- The DROA enhanced monitoring and coordination will continue until either:
  - (i) The minimum probable projected elevation remains above 3525' for 24 months; or
  - (ii) the process moves to the next step when the Most Probable 24-MS projects Powell elevations below 3,525 feet and a specific Drought Response Operations Plan is developed. (Section II.A.4.b)

Lake Powell Unregulated Inflow
Water Year 2021 Forecast *(issued March 2)*
Comparison with History



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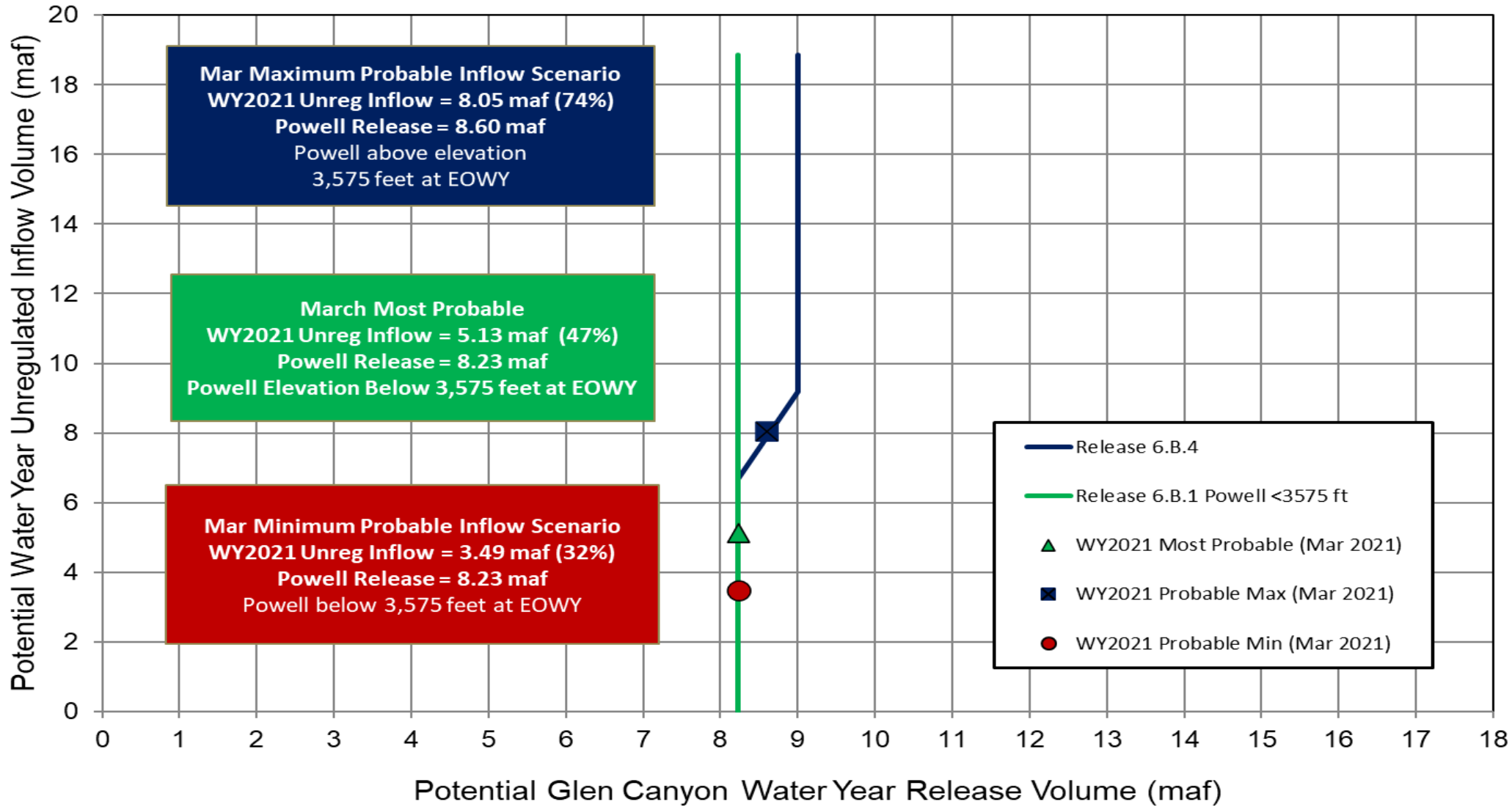
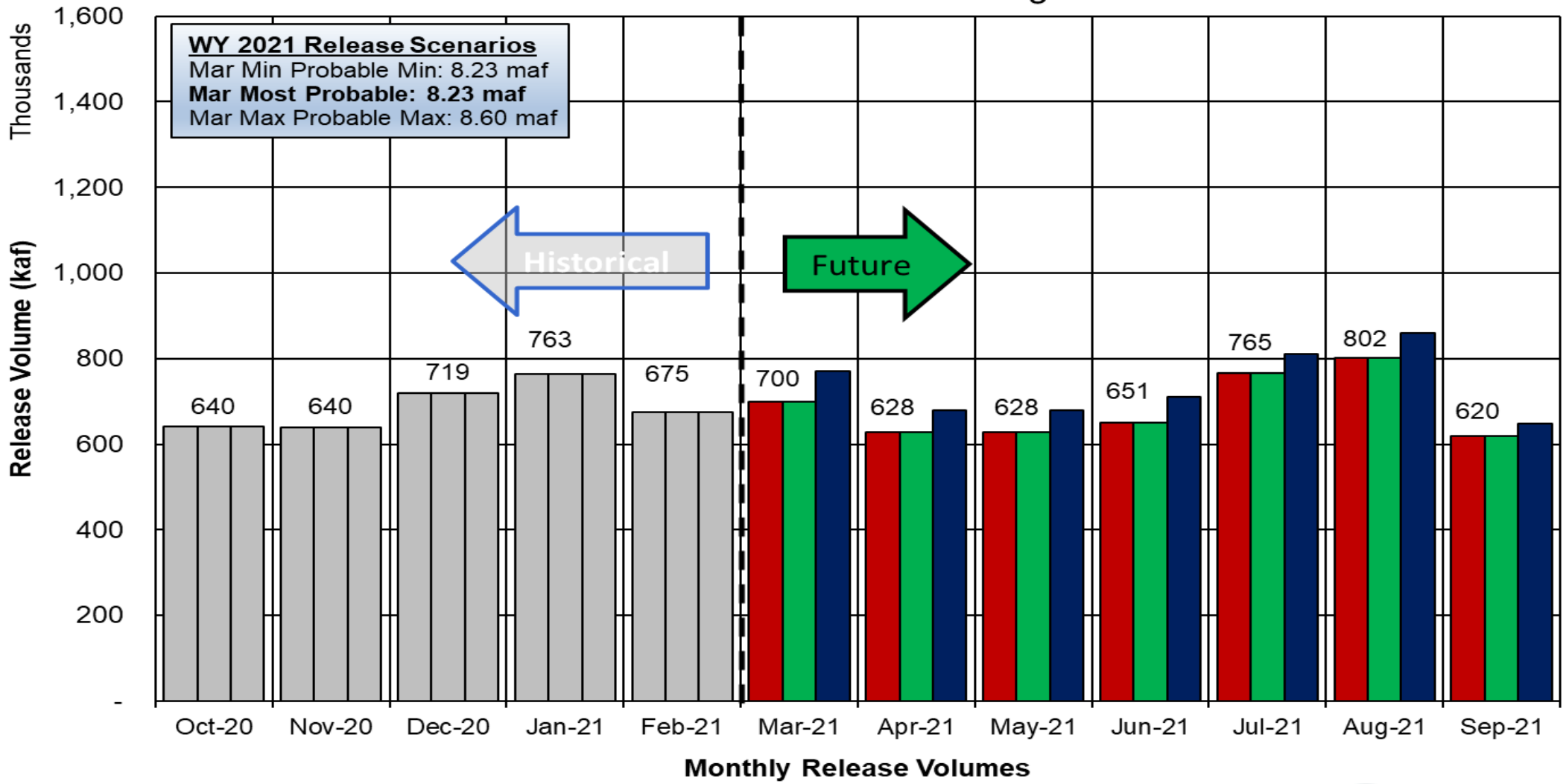
Lake Powell Release Scenarios under Section 6.B

Water Year 2021 Release Volume as a Function of Upper Elevation Balancing Tier
based on March 2021 24-Month Study Conditions



Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2021
Based on March 2021 Modeling



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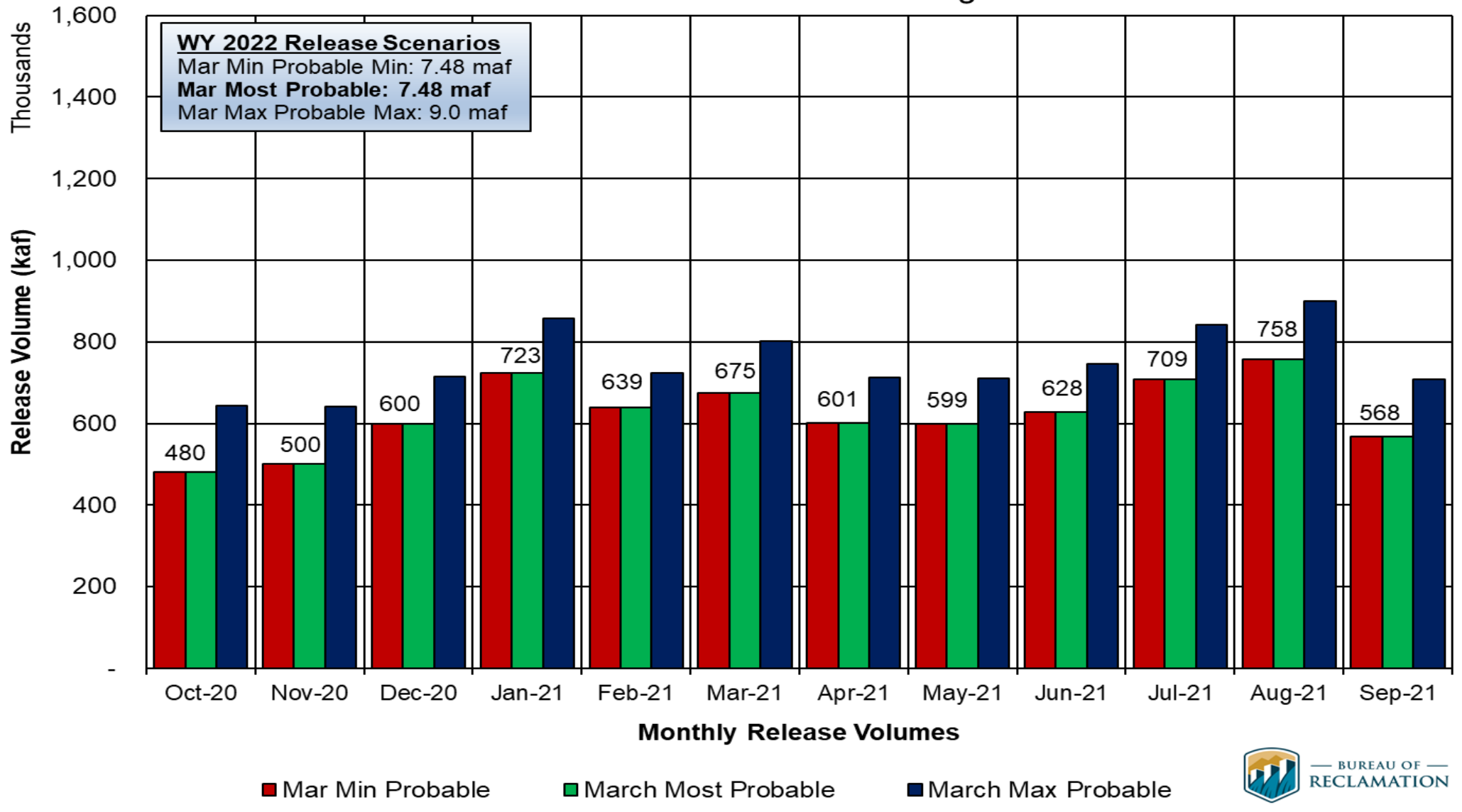
Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2022
Based on March 2021 Modeling



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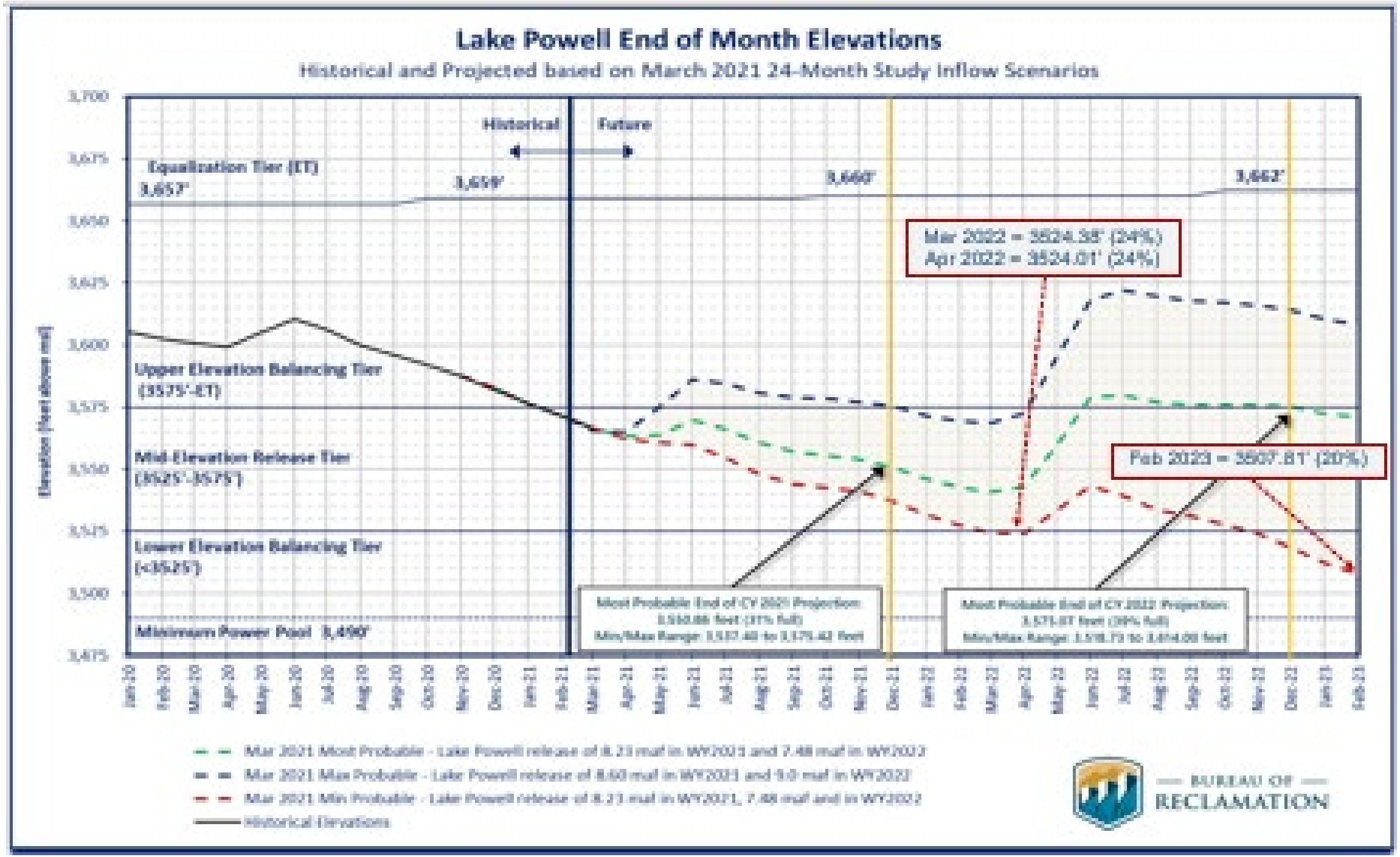
Lake Powell End of Month Elevations
Historical and Projected based on March 2021 24-Month Study Inflow Scenarios
Historical
Future
Equalization Tier (ET)
3,657'
3,659'
3,660'
3,662'
Mar 2022 = 3524.38' (24%)
Apr 2022 = 3524.01' (24%)
Upper Elevation Balancing Tier
(3575'-ET)
Mid-Elevation Release Tier
(3525'-3575')
Feb 2023 = 3507.81' (20%)
Lower Elevation Balancing Tier
(<3525')
Minimum Power Pool 3,490'
Elevation (feet above msl)
Most Probable End of CY 2021 Projection:
3,510.88 feet (31% full)
Min/Max Range: 3,507.48 to 3,575.42 feet
Most Probable End of CY 2022 Projections:
3,575.07 feet (39% full)
Min/Max Range: 3,518.73 to 3,614.08 feet
Mar 2021 Most Probable - Lake Powell release of 8.23 maf in WY2021 and 7.48 maf in WY2022
Mar 2021 Max Probable - Lake Powell release of 8.60 maf in WY2021 and 9.0 maf in WY2022
Mar 2021 Min Probable - Lake Powell release of 8.23 maf in WY2021, 7.48 maf and in WY2022
Historical Elevations
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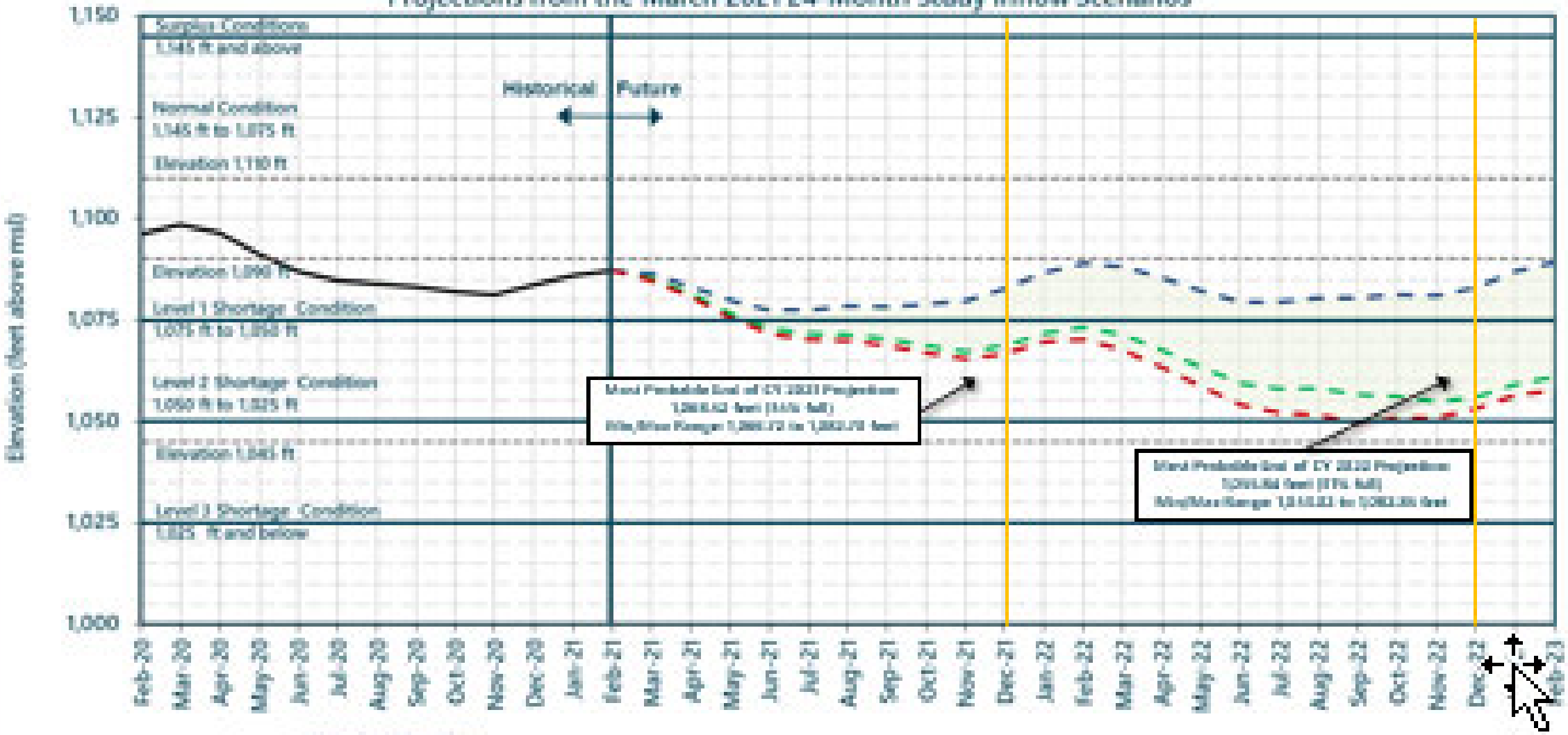
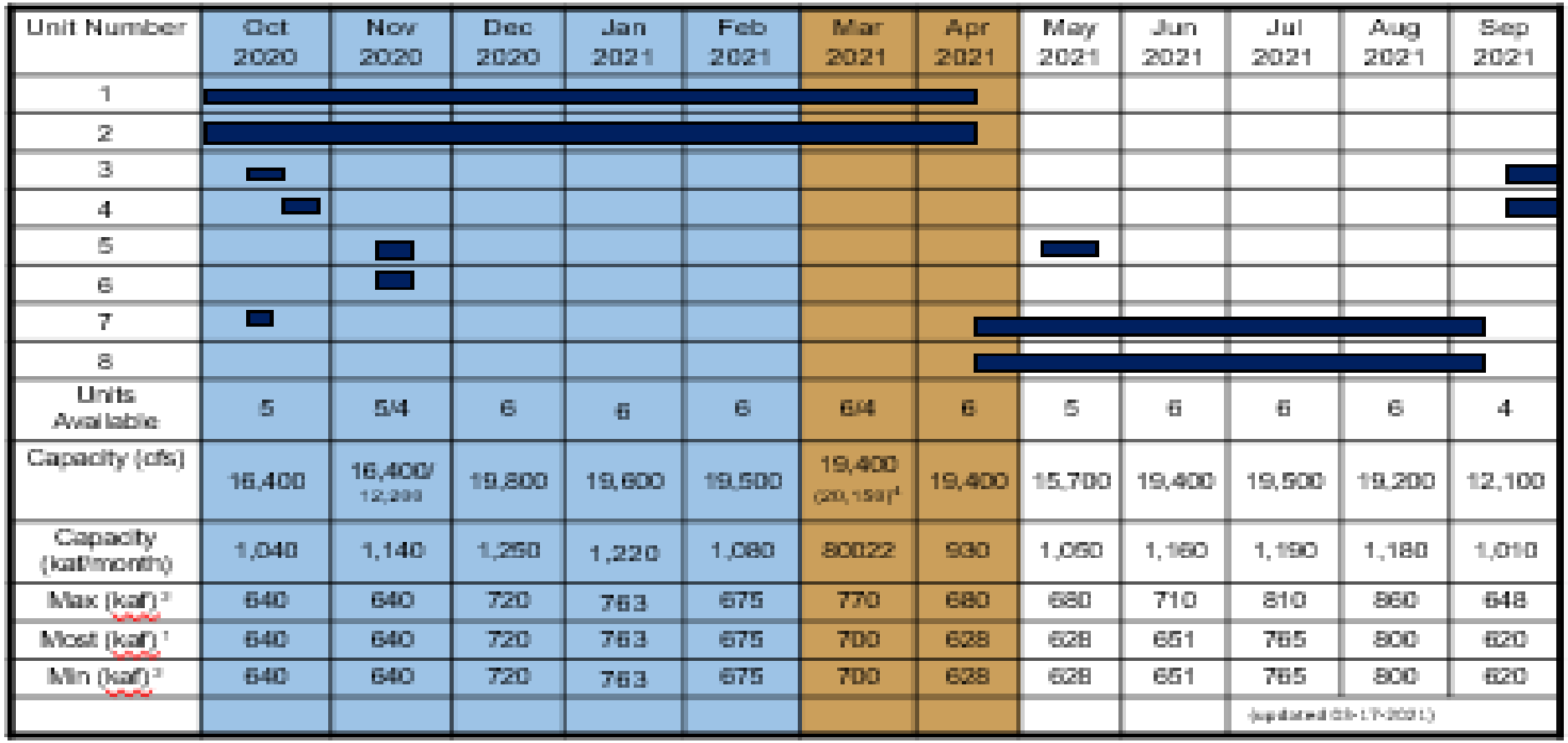
Lake Mead End of Month Elevations

Projections from the March 2021 24-Month Study Inflow Scenarios



Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2021



Unit Number	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	Jun 2021	Jul 2021	Aug 2021	Sep 2021	
Units Available	5	5/4	6	6	6	6/4	6	5	6	6	6	4	
Capacity (cfs)	16,400	16,400/ 12,200	19,800	19,600	19,500	19,400 (20,150)[4]	19,400	15,700	19,400	19,500	19,200	12,100	MAR MOST[2]
Capacity (kaf/month)	1,040	1,140	1,250	1,220	1,080	80022	930	1,060	1,160	1,190	1,180	1,010	MAR MOST
Max (kaf)[2]	640	640	720	763	675	770	680	680	710	810	860	648	8.60
Most (kaf)[1]	640	640	720	763	675	700	628	628	651	765	800	620	8.23
Min (kaf)[2]	640	640	720	763	675	700	628	628	651	765	800	620	8.23
										(updated 03-17-2021)			

1 Projected release, based on March 2021 Most Probable Inflow Projections and 24-Month Study model runs.
2 Projected release, based on March 2021 DROA Min and Max Probable Inflow Projections and 24-Month Study model runs.
3 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-40MW (3%) at current efficiency.
4 Increased capacity available from shifting contingency reserves for Spring Disturbance Flow.

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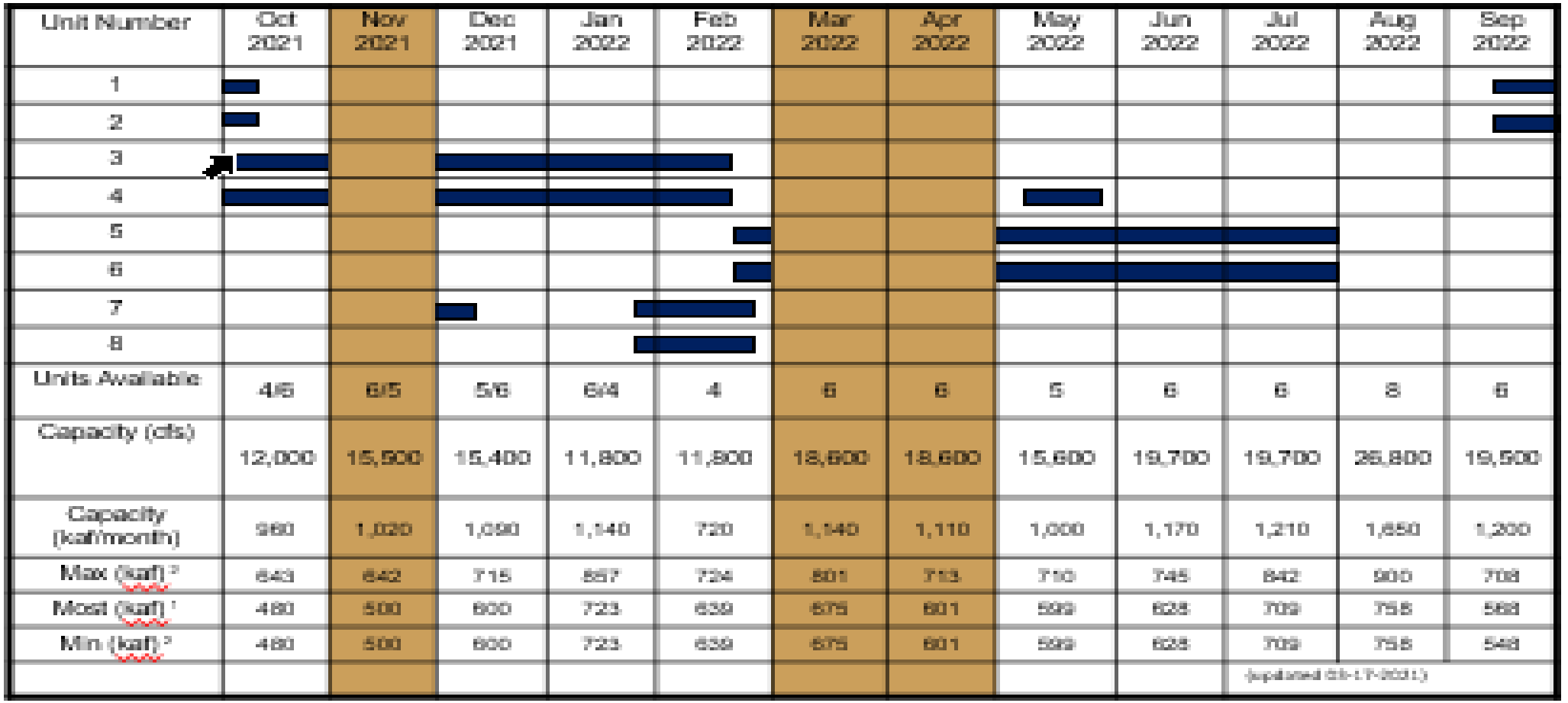
Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2022



Unit Number	Oct 2021	Nov 2021	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	
1													
2													
3													
4													
5													
6													
7													
8													
Units Available	4/5	6/5	5/6	6/4	4	6	6	5	6	6	8	6	
Capacity (cfs)	12,000	15,500	15,400	11,800	11,800	18,600	18,600	15,600	19,700	19,700	26,800	19,500	MAR MOST[3]
Capacity (kaf/month)	980	1,020	1,050	1,140	720	1,140	1,110	1,000	1,170	1,210	1,650	1,200	MAR MOST
Max (kaf)[2]	643	642	715	857	724	801	713	710	745	842	900	708	9.0
Most (kaf)[1]	480	500	600	723	639	675	801	599	628	709	758	568	7.48
Min (kaf)[2]	480	500	600	723	639	675	801	599	628	709	758	548	7.48
										(updated 03-17-2021)			

1 Projected release, based on March 2021 Most Probable Inflow Projections and 24-Month Study model runs.
2 Projected release, based on March 2021 DROA Min and Max Probable Inflow Projections and 24-Month Study model runs.
3 Dependent upon availability to shift contingency reserves, which will increase capacity by 30-60MW (3%) at current efficiency.

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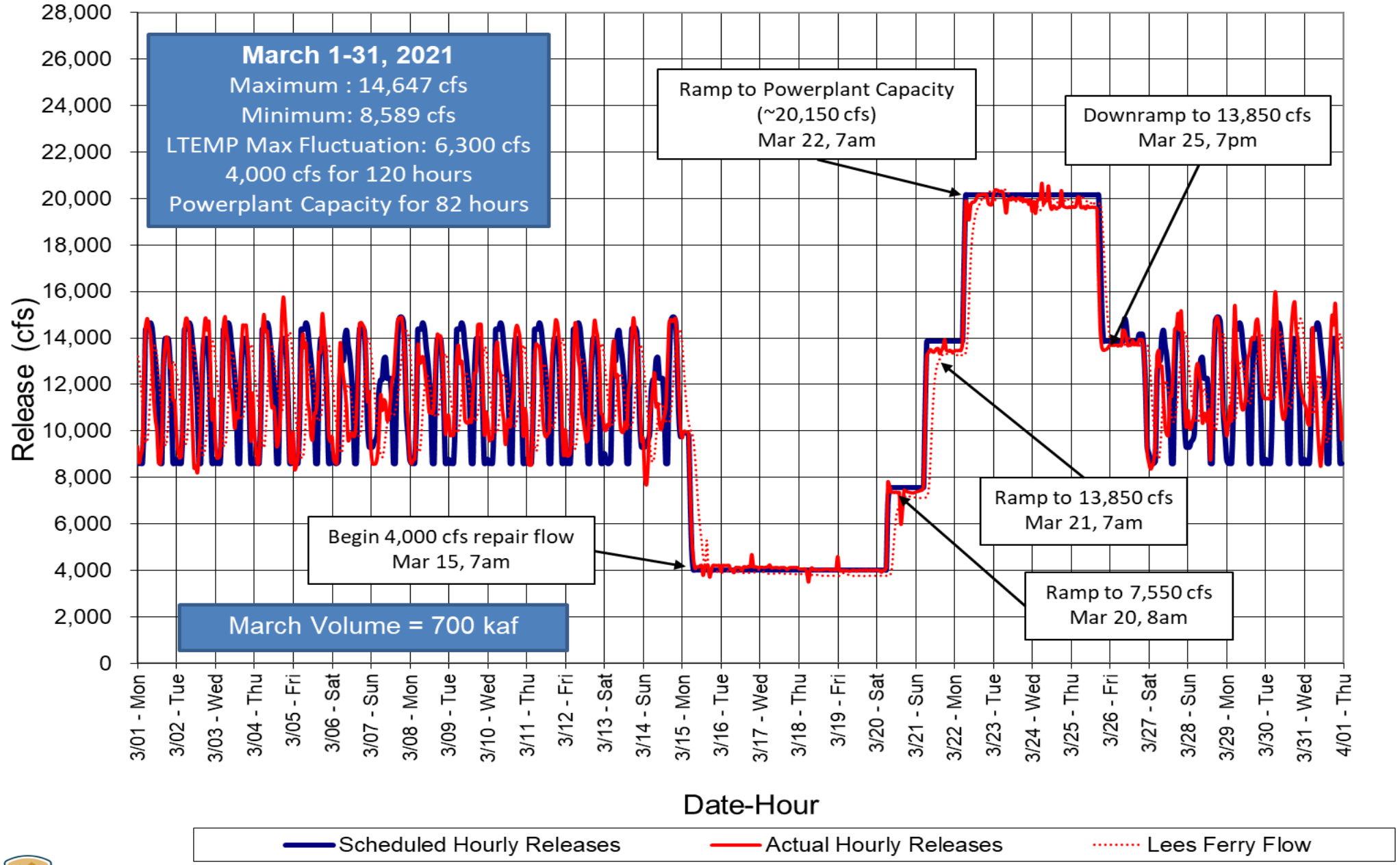
Glen Canyon Dam Hourly Release Pattern March 2021



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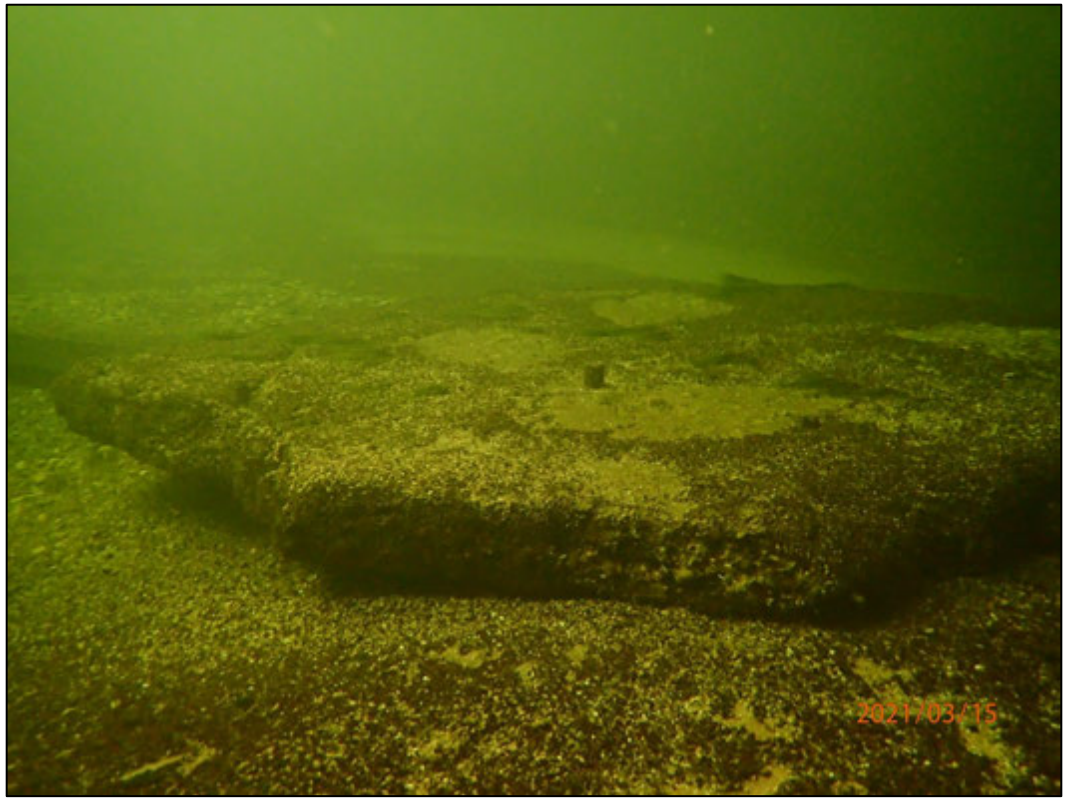
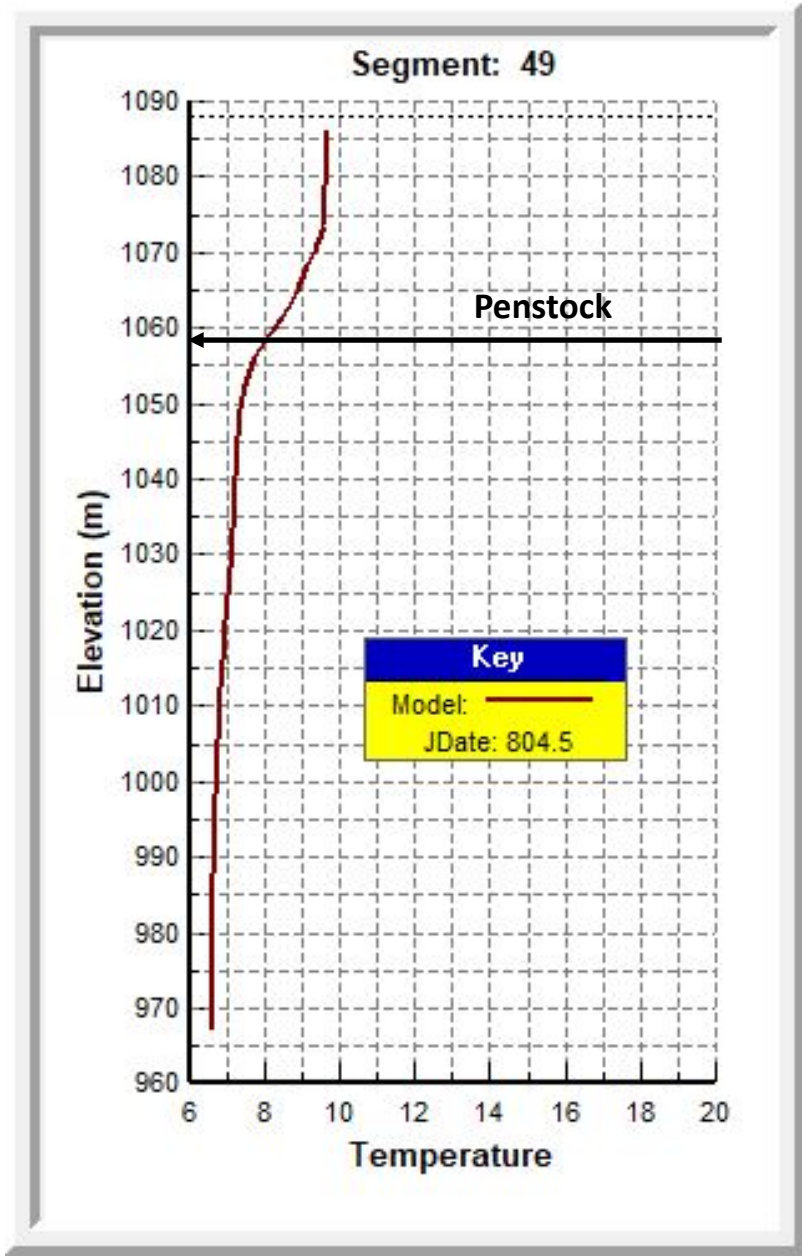

2021/03/15

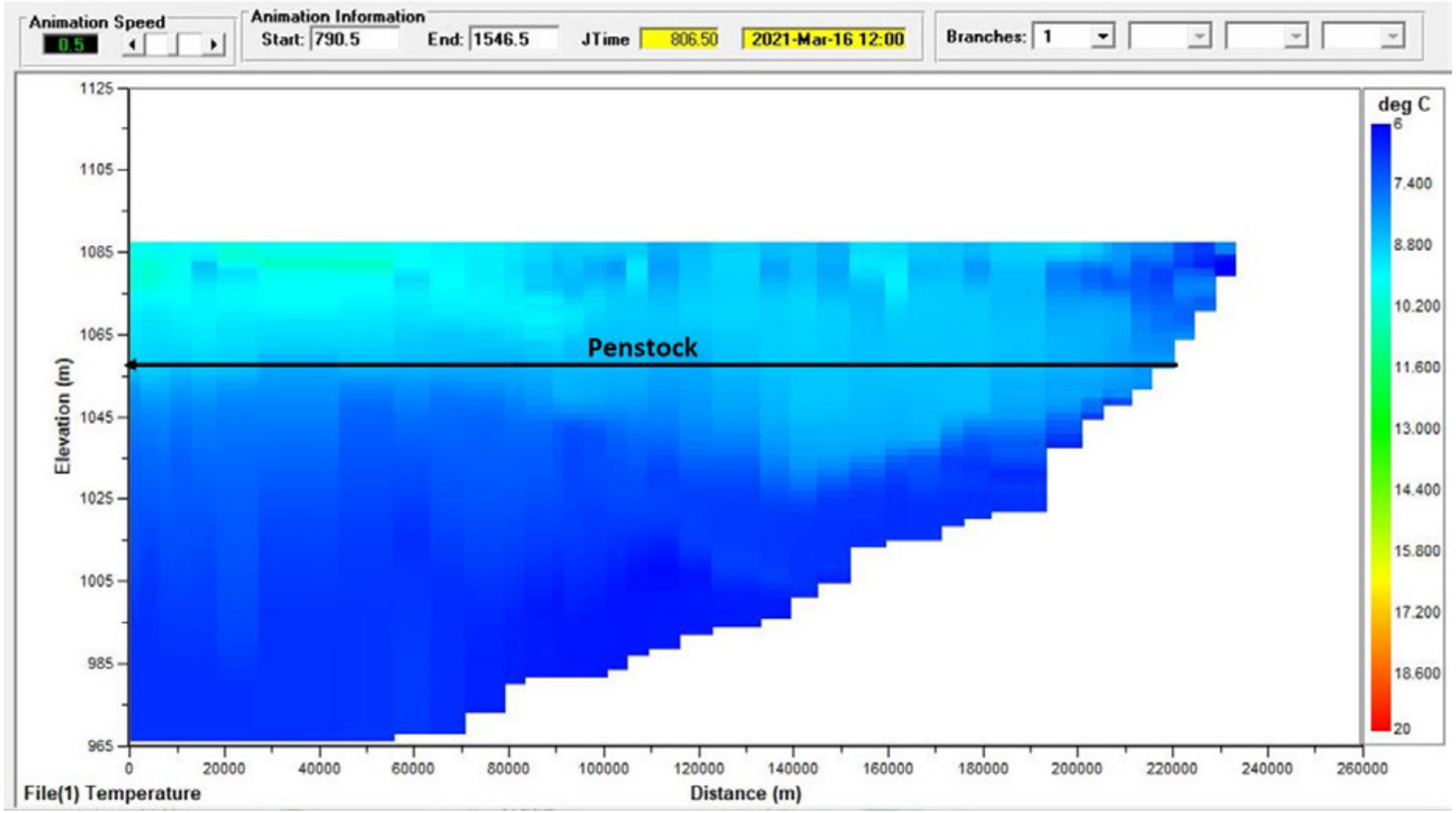
Water Quality

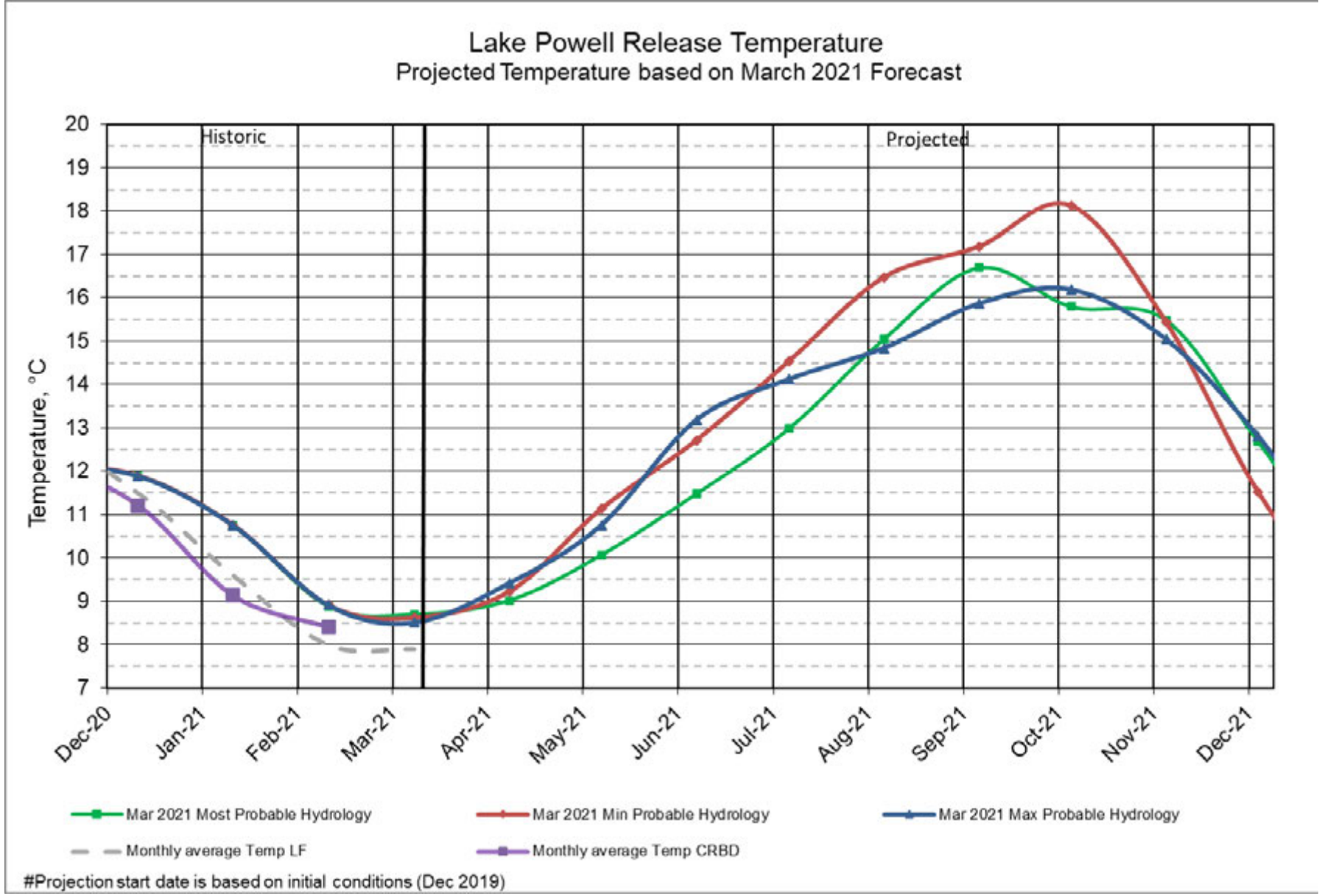
Temperature Profile of Lake Powell near Glen Canyon Dam
3/14/2021

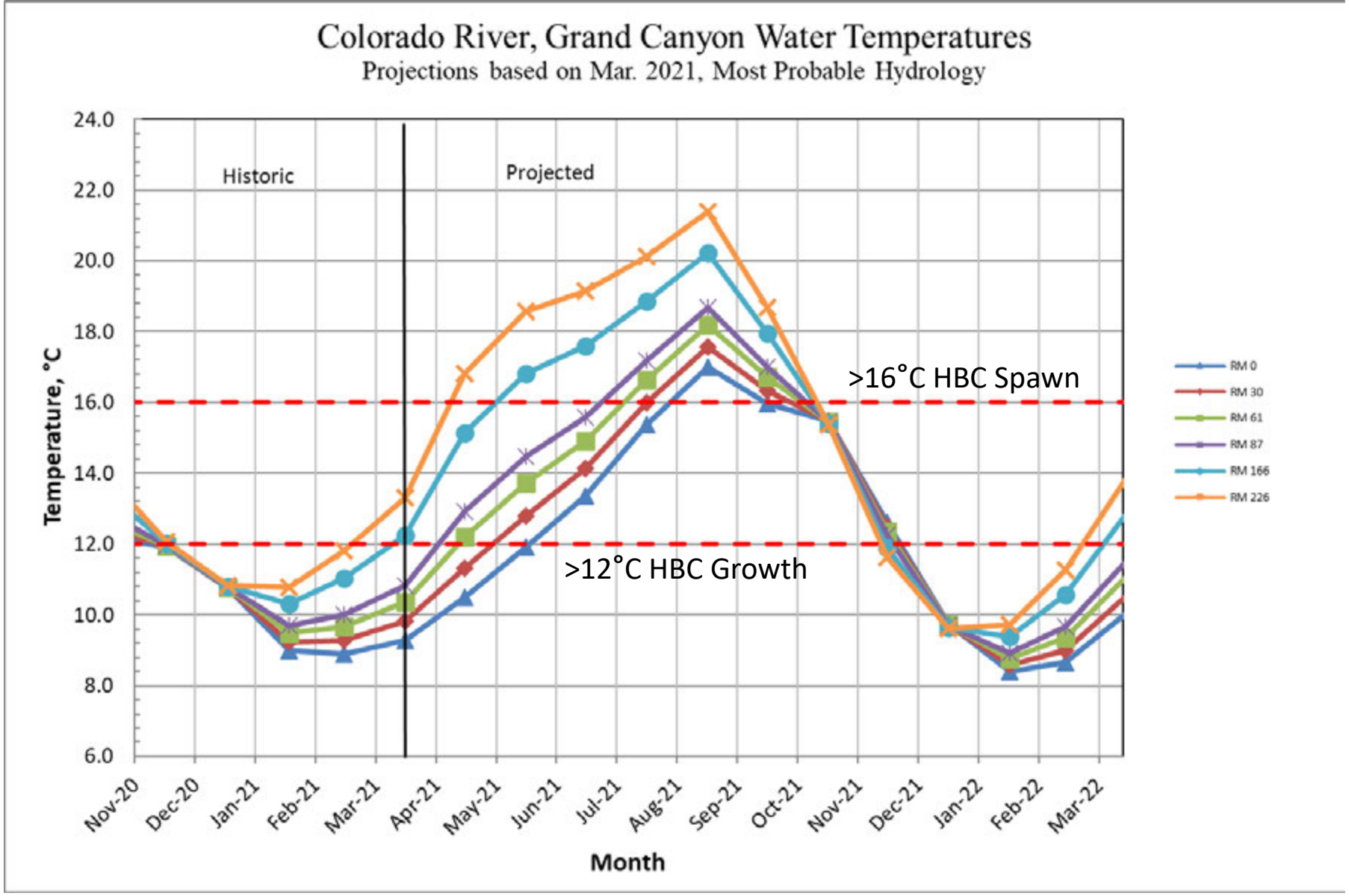


Cross Sectional Temperature Profile of Lake Powell

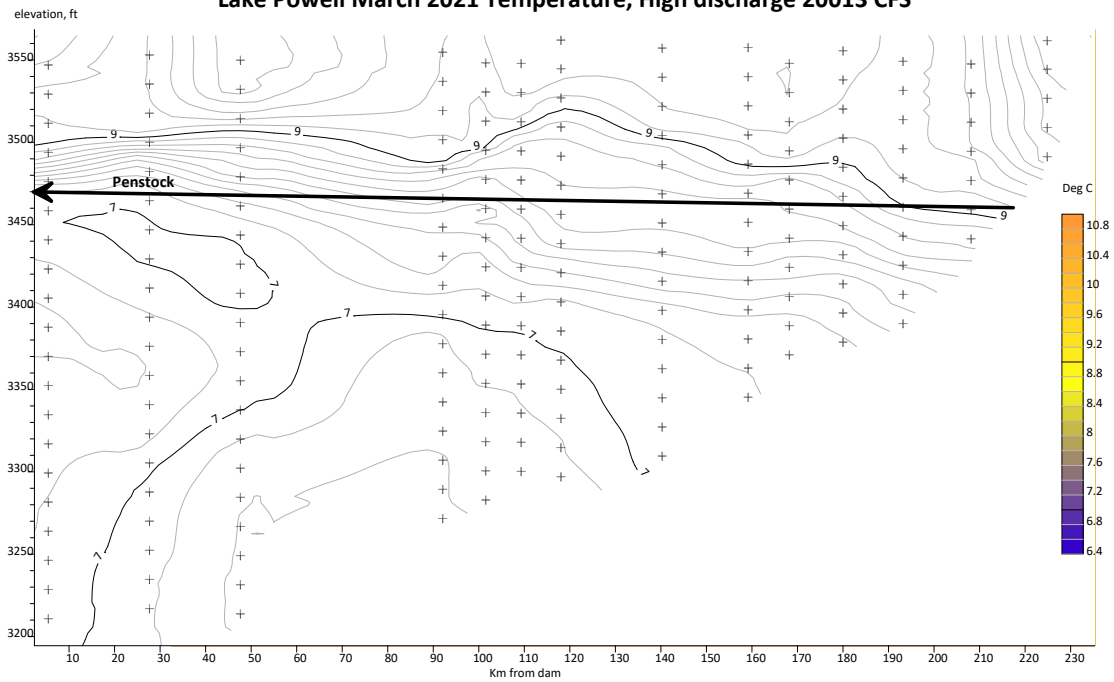
3/16/2021



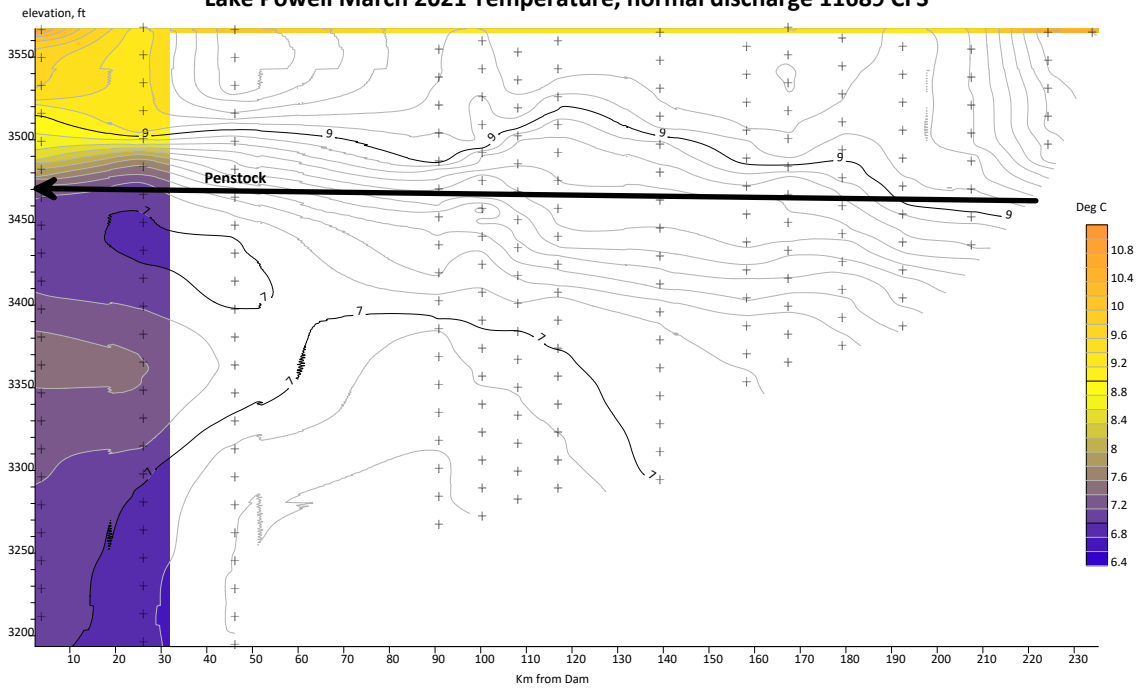

Lake Powell Release Temperature
Projected Temperature based on March 2021 Forecast
Historic
Projected
Temperature, °C
20
19
18
17
16
15
14
13
12
11
10
9
8
7
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Mar 2021 Most Probable Hydrology
Mar 2021 Min Probable Hydrology
Mar 2021 Max Probable Hydrology
Monthly average Temp LF
Monthly average Temp CRBD
#Projection start date is based on initial conditions (Dec 2019)


Colorado River, Grand Canyon Water Temperatures
Projections based on Mar. 2021, Most Probable Hydrology
Historic
Projected
>16˚C HBC Spawn
>12˚C HBC Growth
Temperature, °C
Month
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21
Jun-21
Jul-21
Aug-21
Sep-21
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22
Mar-22
RM 0
RM 30
RM 61
RM 87
RM 166
RM 226

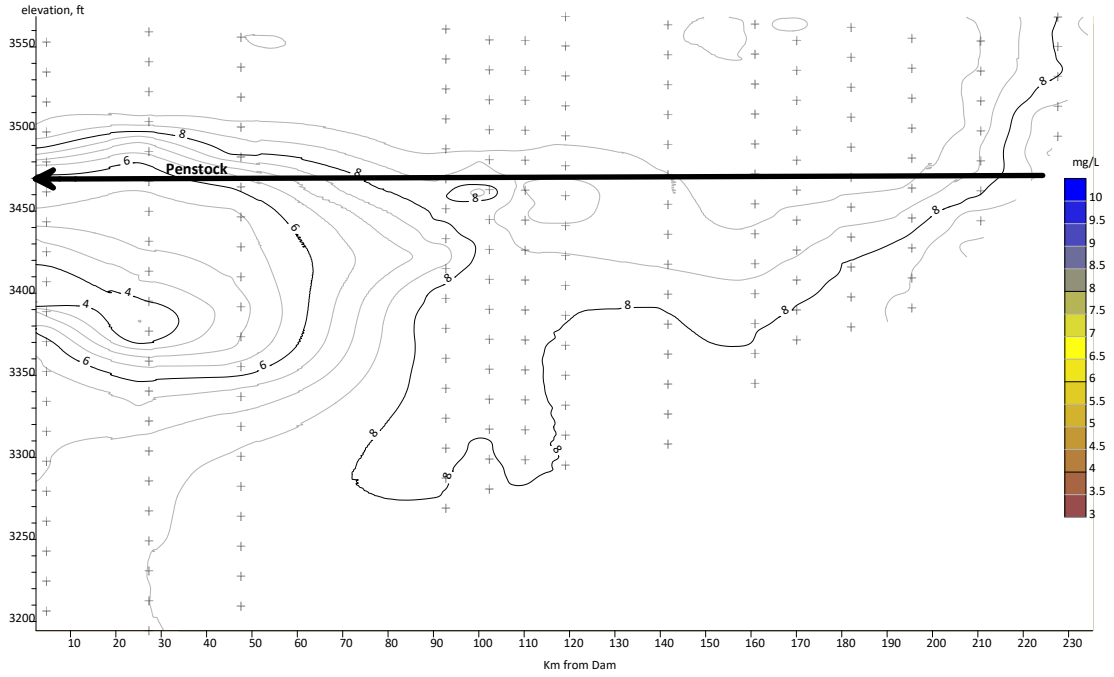
Lake Powell March 2021 Temperature, High discharge 20013 CFS



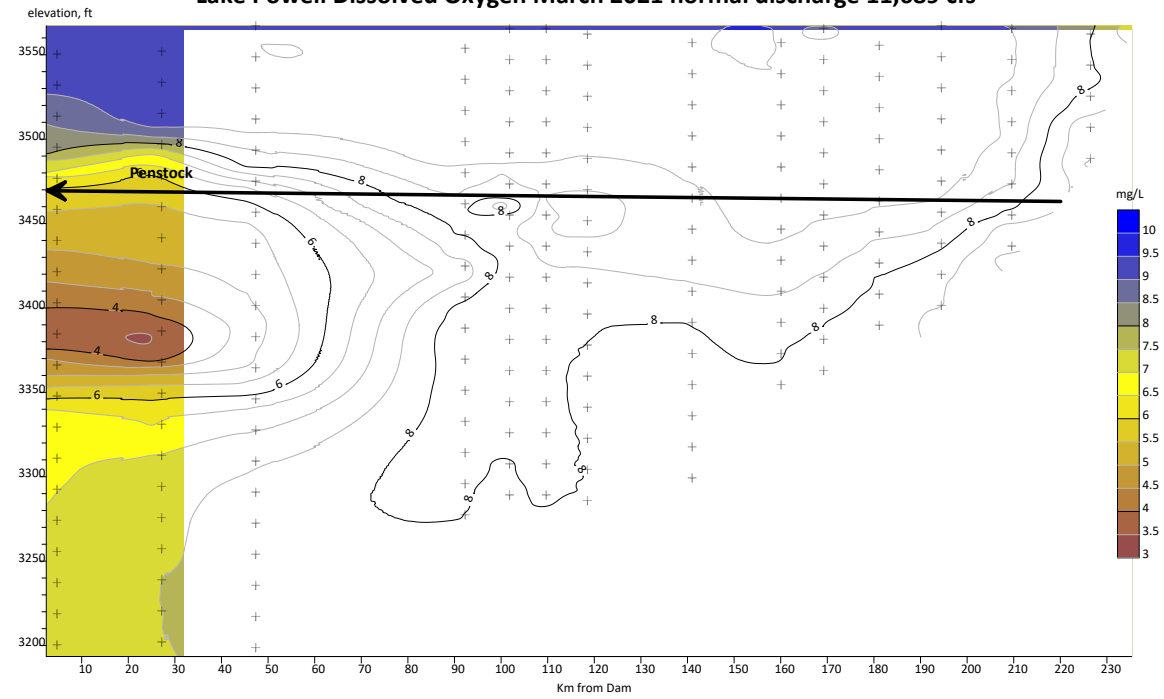
Lake Powell March 2021 Temperature, normal discharge 11689 CFS



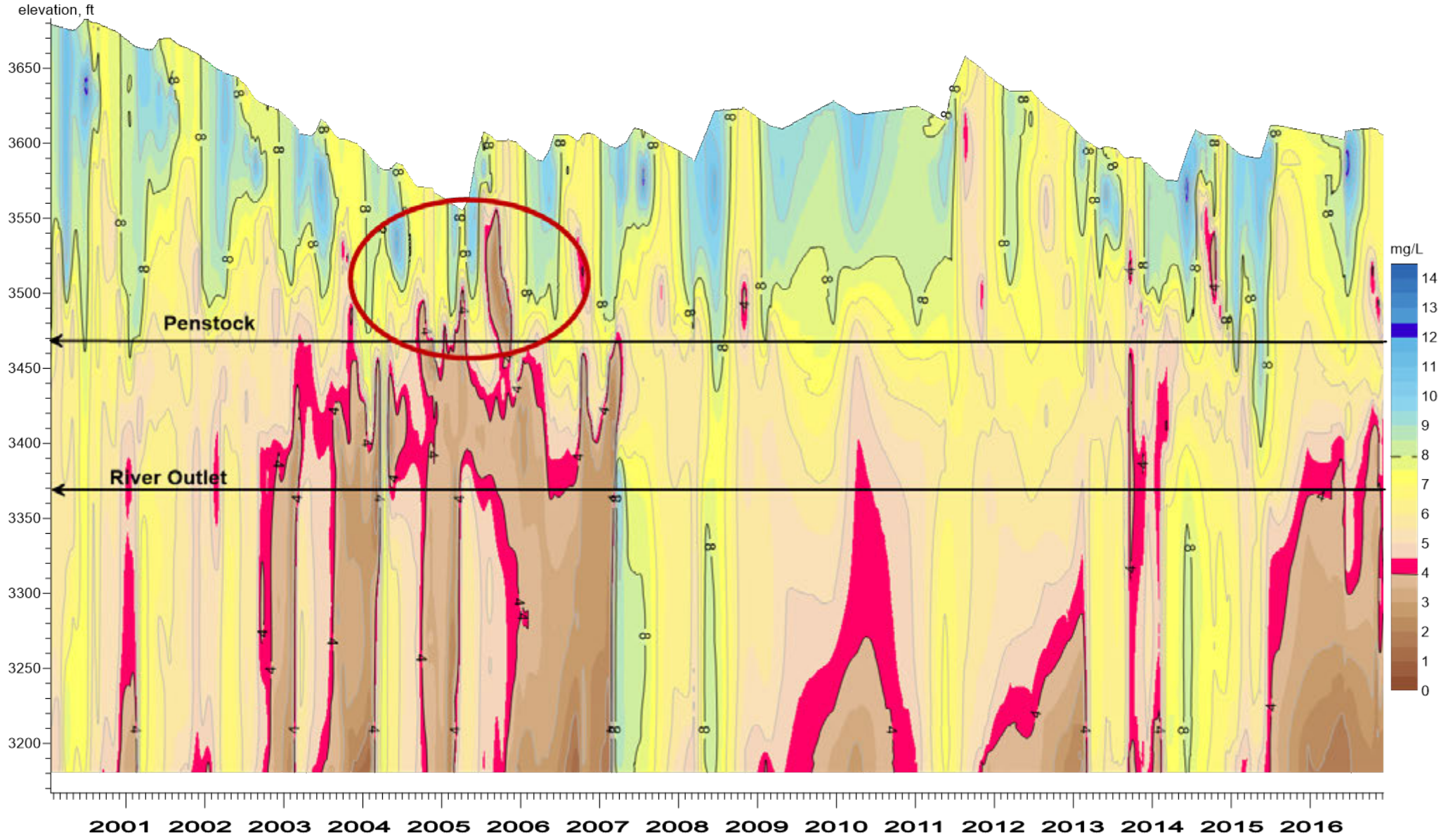
Lake Powell March 2021 Dissolved Oxygen, high discharge 20,013 cfs



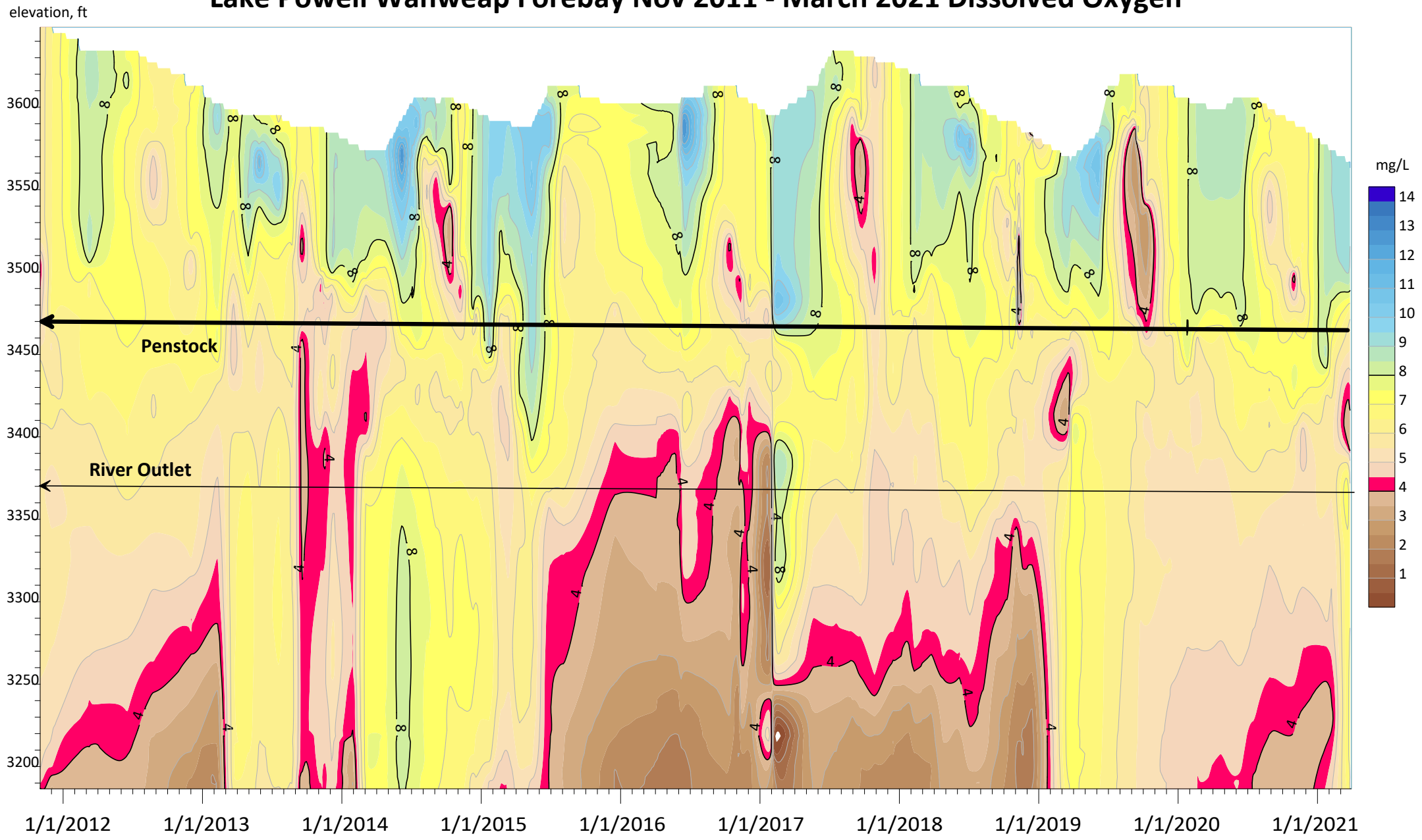
Lake Powell Dissolved Oxygen March 2021 normal discharge 11,689 cfs



Lake Powell Forebay Dissolved Oxygen 2000 - 2016



Lake Powell Wahweap Forebay Nov 2011 - March 2021 Dissolved Oxygen



Questions/Discussion

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